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TO

YOUNG MARKSMEN,

IN ALL THAT RELATES TO THE

GENERAL CONSTRUCTION, PRACTICAL MANIPULATION, CAUSES AND LIABILITY TO ERROR IN MAKING ACCURATE PERFORMANCES, AND THE THEORETIC PRINCIPLES UPON WHICH SUCH ACCURATE PERFORMANCES ARE FOUNDED,

AS EXHIBITED IN THE

IMPROVED AMERICAN RIFLE.

BY

JOHN RATCLIFFE CHAPMAN,

CIVIL ENGINEER.

"Whatever state shall thoroughly comprehend the nature and advantages of rifle pieces, and having facilitated and completed their construction, shall introduce into their armies their general use, with a dexterity in the management of them, will by this means acquire a superiority, which will almost equal any thing that has been done at any time by the particular excellence of any one kind of arms, and will perhaps fall but little short of the wonderful effects which histories relate to have been formerly produced by the first inventors of fire-arms."—ROBINS, 1748.

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MDCCCXLVIII.

TO

THE YOUNG MARKSMEN

OF THE UNITED STATES,

This Treatise

ON THEIR FAVORITE WEAPON,

IS HUMBLY

DEDICATED,

BY THEIR FELLOW-MARKSMAN,

JOHN R. CHAPMAN.

ERRATA.

Page 30, line 12, for 'bands,' read '*lands*.'

PREFACE.

If I had not, during the commencement and course of my Rifle practice, found and felt the want of some guide which would assist me in acquiring the correct use of the rifle, and facilitate the conception of the principles upon which such correct use is founded, I should never have troubled my brother marksmen with this attempt at a treatise on the "Improved American Rifle." I could wish my readers to understand, that the outline and greater part of the text were originally written in the fall and winter of 1844, and nothing hindered its publication at that time but a cautious diffidence, which my friends have at last removed. I am willing to admit that my opportunities for observation and experiment have been very great, devoting all

my time to hunting, fishing, and target practice, and sparing no expense in experiment; assisted also and furnished with weapons by the best mechanics of the age.

I am not aware of any treatise, published either in this country or England, that is of any use to an inquiring marksman. The observations and deductions of Robins, made more than a century ago, stand out, however, as a monument of profundity of thought, grasp of conception, clearness of expression, and prophetical accuracy, which compel us to admire, nay, almost worship, the genius of that eminent man. "Scloppetaria," or "Remarks on Rifle Practice," was written by a corporal in the British Rifle service, and published in London in 1804. It is a fair performance, but falls very short of what is required by the marksman of the present day. The article "Rifle," in all the Cyclopœdias is very dry and barren; and in Dr. Ure's it requires re-writing. "Greener on Gunnery" devotes a few pages to the examination and condemnation of Dr. Ure and the belted bullet, making extracts from Robins, advocating a decreasing twist, and reasoning sensibly upon the advantages of proportioning the size of the grain of the powder to the diameter of the calibre. Col. Hawker, in his "In-

structions to young Sportsmen," merely makes some observations on the two-grooved or belted bullet, but says enough to convince me that his knowledge of the rifle is very limited. The rifle is also noticed by other British authors, but in a manner so slovenly and inaccurate, as not to merit particular attention. The fact is, the rifle since its invention has been improved but very slowly; owing, I believe, to rifle makers, as a body, possessing fixed or crotchety notions, based upon ignorance and tradition; their mechanical knowledge being limited merely to the use of tools, without possessing that spirit of why? and wherefore? so essential for digging out the truth. Why have the observations and deductions of Robins, (which ought to be printed in letters of gold and hung up in every rifle-maker's shop in the world,) remained so long a dead letter? There is no need for an answer, we perceive it in the structure of almost every rifle. I may be accused of too much severity, but believing somewhat in the doctrine of progression, I could wish to arouse the feelings of this class of men, who have been dozing nearly three hundred years, and appeared determined to remain so, until startled from their slumbers by the thunder of a Wesson Rifle. This weapon, so elegant in appearance, and accurate in

performance, was first manufactured and presented to the notice of the public in the year 1841, by Edwin Wesson, now of Northboro', Massachusetts. Its unsurpassed accuracy is acquired by a more careful attention to the requisites in combination, (the observations and deductions of Robins being almost literally personified,) and further improved by the exclusive right of using Clark's patent loading muzzle, a contrivance more simple and effective than is generally produced in these days of "hackneyed inventions." This weapon since its first appearance has undergone considerable alterations in construction, combination, and mode of sighting, in compliance with knowledge necessarily gained from its use in regular practice and extensive experiments; and is at the present time continually receiving additions and alterations, as deficiencies and superfluities are found to exist. As an evidence of what has been achieved by the improvement of the American Rifle since 1840, I may be allowed to state, that at that time, the very best rifles of the old school, in the very best marksmen's hands, and in the most favorable weather, could not make a shorter ten-shot string, at 40 rods, than 50 inches; whereas, at the present time, 20 inches is only common shooting. I made a string at that distance

at Syracuse, in the spring of 1845, with one of Morgan James' muzzled rifles, using globe sights, and the wind very variable, which measured centre and centre 13⅝ inches. Although this string never appeared in the papers either to gratify my vanity or puff up James, it was, nevertheless, actually made, as the testimony of such men as Hudson, Malcolm, and Owens, will prove. When the parades of strings we so often see in the papers are thoroughly searched into, we are sure to find that they were never fairly and honestly made, and consequently are merely got up to help a "lame dog along." I am not opposed to a mechanic legitimately forcing a business, "he may cast his bread upon the waters and find it after many days," but if he overstep the bounds of truth, he may happen to find "stones" instead of "bread."

The majority of the people of the Eastern and Northern States are rather credulous; and from an excess of instinctive intelligence, which is not based however on real knowledge, very likely to believe any thing that is told with the appearance of truth. John Bull is very differently constituted; he rests so much upon the knowledge and tradition of his forefathers, that however obvious any thing may appear, conviction will have to be forced by fell ex

perience. This quality, no doubt, gave rise to the expression of Napoleon, "that the English were such fools as not to know when they were beaten;" they having imbibed from their fathers the impression that one Englishman was a match for three Frenchmen.

King Hen. My people are with sickness much enfeebled;
My numbers lessen'd, and those few I have
Almost no better than so many French:
Who, when they were in health, I tell thee, herald,
I thought upon one pair of English legs
Did march three Frenchmen.—Yet forgive me God,
That I do brag thus!

SHAKSPEARE, *King Hen. V.*

I must apologize for any deficiencies that may appear in these pages in conception, style, or language; my aim being to establish truth and knowledge, with such powers as nature and education have endowed me, relying more upon the merits of intention than execution.

ONEIDA LAKE, MADISON CO., N. Y.
February 20, 1848.

CONTENTS.

INTRODUCTION.

PAGE

Method of obtaining the curve of the line of flight of a Rifle bullet, ... 26

Penetration of flat-ended picket bullets into woods, iron, and cotton, ... 27

Defence of target-shooting as a rational amusement, . 29

General characteristics of the European Continental, and English rifles, ... 31

The zone, or belted bullet, used in the British Rifle service, 32

Peculiarities of the old American rifle, ... 33

Round-ended picket bullet, ... 33

PART FIRST.

ON THE GENERAL CONSTRUCTION OF THE IMPROVED AMERICAN RIFLE, WITH ITS NECESSARY EQUIPMENTS, AS ADAPTED FOR TARGET PRACTICE, HUNTING, AND WAR.

Description of Wesson's target rifle, with Clark's patent loading muzzle, ... 37

Description of bead sight, ...

Description of bead sight index, ... 42
Description of globe sight, ... 42
Prices of the Wesson target rifle, ... 43
Description of target rifle without patent loading muzzle, 43
Suggestions for its use as a weapon of war, ... 44
Description of a four-barrelled revolving rifle, for the purpose of hunting and war, ... 46
Description of a 12 inch Wesson pistol, ... 49
Description of the author's telescopic sights and movements connected therewith, ... 51
Reasons why the old short telescopes failed as rifle sights, 53
Cost of telescopic sights made by M. James, Utica, . . 55
Description of the wiper, ... 56
Description of the wiping rags, ... 57
Description of the charger, ... 57
Description of powder proper for target rifles, . . . 58
Composition of gunpowder known to the Chinese centuries ago, ... 59
Description of bullet moulds, and mode of casting the bullets, ... 60
Description of caps most suitable for target practice and hunting, ... 63
Description of the construction and use of the swedge, . 64
Description of linen proper for patches, the mode of cutting them, and a rule for proportioning them to the size of the bullet, ... 66
Description of the guide starter, ... 67
Description of the common straight starter, ... 68
Description of an ammunition box used by the author, . 68

Descrpition of a portable rest used by the author, . . 70
Description of the flags, used as indicators of the strength and direction of the wind, ... 72
Description of the size of white target rings for different ranges, ... 72
Description and sizes of wooden targets for different ranges, 73
Necessity of a suitable barrier for the purpose of stopping the bullets, ... 74
Necessity of a refracting telescope for observing the bullet holes in the target, ... 74

PART SECOND.

ON THE PRACTICAL MANIPULATION OF THE IMPROVED AMERICAN RIFLE, AT REST AND OFF-HAND TARGET PRACTICE.

Requirements for making a good marksman at rest and off-hand rifle practice, ... 79
Exaggeration of the performances of the rifle by Cooper the novelist, ... 80
Particular instructions for target practice at rest, . . 81
Method of calculating the variations effected by the front and back sights, with directions for application, . 84
Instructions for target shooting in windy weather, . 85
Description and illustrations of the different styles of target shooting, ... 86
Comparisons of weapons with different calibres at 220 yards, ... 87
Instructions as to position at rest, and mode of practising in variable windy weather, ... 88

Caution against *canting* the weapon sideway, ... 90
Fair meaning of the term "off-hand," 91
The Mississippi off-hand dodge, ... 91
Description of rifle suitable for off-hand shooting, . . 91
Particular description of position at off-hand, . . . 91
Advice to those troubled with the *buck fever*, . . . 93
Advice as to cleaning and oiling a rifle, ... 94
Performances which a marksman ought to make at rest, and off-hand, ... 95
Description of the advantages of the telescopic sight, . 96
Description of shooting matches at Syracuse, Sherburne, and West Troy, ... 98
Recommendation of Morgan James, Utica, N. Y., as a manufacturer of rifle telescopes, ... 99
Recommendation of E. Wesson, of Northboro, Mass., as a manufacturer of target rifles, with Clark's patent loading muzzle, ... 99
Recommendation of other makers of good repute, . . 100

PART THIRD.

ON THE CAUSES AND LIABILITY TO ERROR IN MAKING ACCURATE PERFORMANCES.

Liability to error in wiping out irregularly . . . 103
Object sought for in wiping out, ... 103
Necessity of *weighing* the charges of powder, and the amount of error a marksman is liable to make in using the common charger, ... 104
Large valves in the powder flasks objectionable, . . 106

Necessity of refilling the flask when nearly empty, . 107
Liability to error from unevenness of texture of the linen used for patching, and the necessity of having the patch concentric with the butt of the bullet, . 108
The imperative necessity of similarity in weight, size, and figure of the bullets, ... 109
Starting the bullets irregularly, and not twice alike, a fruitful source of error: reasons thereof with illustrations, 109
Necessity of placing the bullets lightly upon the powder, and avoiding the *ram jam* system, ... 112
Ideas for the improvement of target rifle, ... 114
Upsetting of leaden bullets, ... 115
Reasons why Dupont's and English rag gunpowder does not perform first rate in target rifles, ... 116
Suggestion for the employment of the highest propellant power of which gunpowder is capable, either in a rifle or cannon, ... 117
Advisable not to overwork a rifle, ... 118
Irregular shooting caused by *canting* the rifle, . . 118
Suggestion for *canting* the weapon, for the purpose of counteracting the action of the wind sideway, . . 119
Liability of all marksmen to *flinch*, ... 119
Target rifles of all makers based upon the general principle of the Wesson Rifle, ... 120
Investigation of the policy of Mr. A. Clark, in allowing one maker to engross the exclusive right of manufacturing and using the patent loading muzzle, . . 120
Marksmen compelled to use the best weapon that can be found, ... 122

PART FOURTH.

ON THE THEORETIC PRINCIPLES UPON WHICH ACCURATE PERFORMANCES OF THE RIFLE ARE FOUNDED.

Notice of Robins, the philosopher and mathematician, . 127
Notice of Dr. Ure and the belted bullet, ... 128
The folly of fulsome national compliments, . . . 128
Comparison betwixt an American backwoodsman and the European rifleman, ... 129
General definition of the principle upon which a rifle is intended to be constructed, ... 130
Mechanical method of obtaining this principle, . . 131
Elements which tend to produce the curve or line of flight of a rifle bullet, ... 131
Description and relation to each other of the line of sight, the line of flight, and the line of the axis of the bore, 132
Explanation of the term *point blank range*, . . 133
Particular principles necessary to be observed in the combination of a perfect rifle
First.—The proper degree of twist, . . . 134
Second.—The advantages of the employment of the increasing twist, ... 135
Third.—The necessity of proportioning the twist to the size and weight of the bullet, combined with the velocity intended to be given to it, . . . 141
Fourth.—The size and weight of the bullet must be proportioned to the distance it is intended to be projected, ... 143

Fifth.—No more powder than a certain proportional length of the calibre can be effectively burnt in a rifle barrel, ... 145

Sixth.—The size of the grain of gunpowder ought to be proportioned to the length and diameter of the bore of the barrel, ... 148

Condensed opinion of the principal points essential for good combination, ... 149

Reduction of friction of the bullet, how far it may be carried with safety, ... 151

Fallibility of man's productions, ... 152

Explanation of the term "circle of error," . . . 152

Explanation of the term "parallelogram of error," . . 154

Observations upon monster pieces of ordnance, . . . 154

Conclusion, ... 157

Progressive improvement, ... 158

LIST OF PLATES AND WOODCUTS.

PLATES.

PAGE

1. Position at off-hand rifle practice.—FRONTISPIECE.
2. View of target rifles, &c., ... 37
3. Rifle illustrations, ... 51
4. Rifle equipments, ... 61
5. Do. do. 71
6. Targets at rest at 220 yards, ... 87
7. Do. do. 88

WOODCUTS.

Round-ended picket bullet, ... 33
Wiper-ends, ... 56, 57
Illustrations of the cause of inaccurate shooting, from starting the bullets crooked, ... 111, 112

THE

IMPROVED AMERICAN RIFLE.

INTRODUCTION.

In venturing to treat upon the "General Construction, Practical Use, and Theoretic Principles of the Improved American Rifle," I must claim the indulgence of my readers generally, and particularly of those who are more highly gifted in the knowledge of projectiles and gunnery, as I have not endeavored to record any experiments but what appeared to be requisite for the practical marksman. I have determined very accurately the curve described by a rifle bullet during its flight, from 1 up to 140 rods; and not from theoretic calculations, but from ascertained data, which can also be obtained by any one who has time

and convenience at his command. This can be accomplished with a rifle, so far as it will perform with tolerable accuracy, in the following manner: Provide yourself with a permanent or fixed target at the extreme distance you intend obtaining the bullet's flight, and fire at it until the shooting is central with the sighting; then, being provided with a light target and ladder of a suitable length, let your assistant place it at a station 10 rods nearer to the rest than the fixed target is, and keeping the sights the same as they were at the extreme range or fixed target, fire three shots at the ladder target, aiming all the time at the fixed target; then measure the distance from where the line of sight cuts the ladder to the centre of the shooting, and note it down in your book. Proceed thus at every 10 rods until you arrive at the rest, and it is obvious you will have all the data for laying down a section, which will denote the curve of the flight of the bullet with great accuracy. The target on the ladder must be contrived to slide up and down by means of a cord running over the top round, so as to accommodate its height

to the flight of the bullet at the different stations. The penetration of flat-ended picket bullets into woods, iron, and cotton, are very interesting, but inferences from such data can only be general, as the texture and density of all such materials are prone to vary from a variety of causes. At the distance of 20 rods, with a 90 to the pound calibre, the bullet being flat-ended and picket shape, weighing 137 grains, with a charge of 56 grains of powder, a rifle 88 calibres long in the barrel projected the bullet 3¾ inches into a piece of seasoned hemlock. The same weapon similarly charged, at the same distance, drove its bullet 1¾ inches into a solid block of seasoned white-oak, and likewise, at the same distance, perforated a piece of boiler-plate ⅛th of an inch thick. At 40 rods it penetrated 3 inches into the seasoned hemlock, and 1¼ inches into the block of seasoned white-oak. I filled a box about 15 inches square and 16 in depth with common cotton-batten, pressed it down as tight as my weight would do it, nailed up the open end with a piece of tanned sheep-skin, then fired a number of shots int-

it, at 40 rods distance, and found that the same weapon with the above charge drove its bullets about 10 inches into the cotton, and contrary to expectation, marred their form and surface much more than if they had been shot into sand, soil, or soft clay.

Upon the "General Construction of Rifles," as practiced in this country and England, I can with safety speak. I commenced using the rifle in England when sixteen years of age, having had one made after the American plan, the outline of which I gathered from some letters on that weapon, written by Junius Redivivus, and published in the Mechanics' Magazine. I got well laughed at for having a barrel 3 feet long, weighing 7 pounds, when the calibre was 60 to the pound only (so contrary to the general ideas of the fowling-piece makers of that country); but when I came to use it, after acquiring some tolerable degree of proficiency in manipulation, the laugh was retorted, the "boot was on the other leg." During a residence of six years in this country, I have devoted myself entirely to the use of the rifle, as a means of amusement in the woods

and at the target, and although some finicking, white-faced townsman may profess to see no rational enjoyment in hunting or shooting at a mark, I can assure him that all people have not the same qualifications, and consequently, not the same means and powers of enjoyment. I am inclined to think, that if young men would devote their leisure hours to fishing, hunting, riding, walking, or shooting at a target, the fruits would be somewhat more valuable than those gathered from mawkish dandyism, card-playing, rowdyism, and debauchery.

So far as practical manipulation is concerned in the use of the rifle, and a knowledge and a feeling of precaution against the causes of error, I do not consider myself inferior to any man. Another may be in possession of some little thing which may have escaped me; so also he may find something in these pages which he did not know previously, and profit thereby, which I am willing he should do, provided his candor will allow him to acknowledge it, or his conscience deter him from claiming that which is not his due.

I have throughout attempted to give the

reader all the knowledge I am possessed of in each department, with the exception of that on "Construction." I do not feel at liberty to swell my pages expressly for the benefit of a bungling mechanic; for if nature have denied him the gifts necessary to form a moderate workman, all the writing in the world will not avail him. If, on the other hand, he be gifted, I have written sufficient for him to get a general insight, and which, in his case, is all that is requisite. I have no object in keeping secret, for private advantage, any information I may be in possession of; for in a case of competition of skill I am willing to rely upon being able to practice effectually, what I publish so openly.

I shall close this introduction by giving a slight sketch of the progress in the construction of the rifle since its invention, which, though wrapped in obscurity, is considered to have been made in Germany in the sixteenth century. The first rifles made in that country were cut with two deep creases opposite to each other, the bullet being round and furnished with two small circular knobs of lead,

large enough to fill the creases. It appears that the original rifling or cutting machines were very deficient, as we find that a piece of lead cast in the barrel, about two inches long, was used as a means of testing the parallelism and evenness of the depth of the cuts, by pushing it up and down along the bore; if it moved along evenly and without obstruction the cutting was pronounced perfect, if not, the barrel was condemned. In the States, no maker of the present day, of any ability, thinks of pursuing such a method of testing, knowing that his machine works too smoothly and regularly to cut the creases out of parallelism, and too much attention is paid to the working of the saw, to have the depth of the creases irregular. The general characteristics of the European continental and English rifles appear to have been, and are at this time, a very large calibre and a comparatively light short barrel, with a quick twist, about one turn in 3 feet, sometimes using a patch and sometimes not; the bullet invariably circular, and its front part flattened by starting and ramming down. The military rifles in England were about 2 feet 6 inches long with a 20 to the pound

calibre, used without patching, and rammed home with a flat-ended iron ramrod. The only principal difference in the fancy rifles was the introduction of a patch, generally of deer-skin, some little wiping out, and some care in starting the bullet so as to bruise it, by using for that purpose a small wooden mallet.

Some twelve years ago the zone or belted bullet was introduced, I believe by Moore, the rifle manufacturer, Edgeware Road, London; although Dr. Ure puts this "*questionable application of a three century invention*" upon the shoulders of Mr. Lovell, the government inspector and superintendent of small-arms. Its performance is certainly better than the old round bullet, used and bruised in the good old way, but I am of opinion that it is much inferior when the round bullet is properly treated in a properly made weapon. The variation of the belted bullet sideway from the action of the wind is awful, and as the axis of its line of flight is not coincident with the zone or belt of lead, (and the quicker the twist the greater the angle,) the resistance of the atmosphere is enormous, which can be judged of by standing near the target, and hearing the

whistling noise made during its flight. Rifles with this description of bullet are now used in the British service, and have, I will admit, some advantages as a fighting weapon over the "old ones."

It appears that the introduction of additional weight in the barrel, and reduction in the size of calibre, the constant use of the patch, a slower twist, generally one turn in 6 feet, combined with what is now known to be a detriment, length of barrel, are exclusively American. It appears that the use of the round bullet was general both for hunting and shooting at a mark, and a round-ended picket of this shape  was occasionally used in some parts of the Eastern, Northern, and Western States, until the invention and introduction by Mr. Alvan Clarke, of Boston, of the flat-ended picket, used in his patent loading muzzled rifle, which allows a much greater charge of powder, producing a quicker flight of the bullet, consequently less variation sidewise from the action of the wind, and flattening the curve of the bullet's flight, approaching very nearly to a

circle.* It is at this stage of the advancement of the art that I am desirous to give, what I have felt to be much needed by the inquiring marksman, a description of the general construction and practical use of the improved American rifle, as adapted for target practice, hunting, and war, with its various equipments, developing the causes and liability to error in making accurate performances, with an examination of the principles upon which such accurate performances are founded.

* I made, and would have inserted, a section showing the line of flight of a rifle bullet at 140 rods, but the length of paper required for its exhibition on a natural scale would be inadmissible in a work of this nature. The result, however, is that the bullet fell 1 foot from the line of the axis of the bore at 23 rods; consequently, the time of its flight was a quarter of a second, and the average velocity 1518 feet in one second of time. At 40 rods the fall of the bullet was 4 feet, the time half a second, and the average velocity 1320 feet in one second. At 80 rods the fall was 23 feet, the time one second and a quarter, nearly, and the velocity 1056 feet per second. At 120 rods the fall was 61½ feet, the time two seconds, nearly, and the average velocity about 990 feet per second. At 140 rods the fall was 94 feet, the time two and a half seconds, nearly, and the average velocity 924 feet per second. The initial velocity, or the velocity the bullet left the muzzle of the piece, is probably near 2500 feet per second. These calculations are only approximations, but exact enough for general purposes.—*Author.*

PART FIRST.

ON THE GENERAL CONSTRUCTION OF THE IMPROVED AMERICAN RIFLE, WITH ITS NECESSARY EQUIPMENTS, AS ADAPTED FOR TARGET PRACTICE, HUNTING, AND WAR.

RIFLE ILLUSTRATIONS.

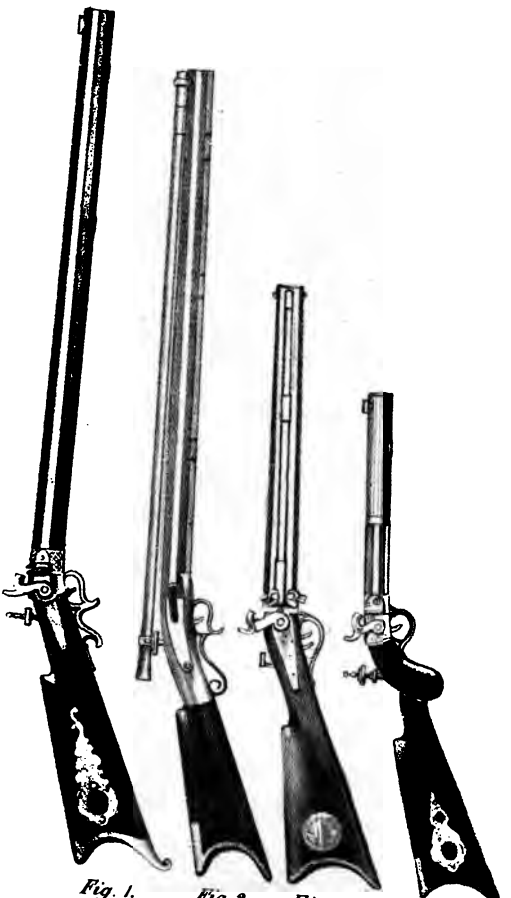


Fig. 1. Fig. 2. Fig. 3. Fig. 4.

W. Endicott Lith. N. York.

Daguerreotyped by Plumbe.

CHAPTER I.

In describing the construction and practical use of the "Improved American Rifle," and the equipments used for target practice at rest, at the present day, I shall take one as a model, which, in my estimation, is adapted for best performance at 40 rods. Fig. 1, Plate 2, exhibits a side view of this weapon of the shape as manufactured by Edwin Wesson, of Northboro', Mass. The barrel is made of cast steel, not very highly carbonized, thoroughly annealed in an air-tight oven, the bore being drilled out of the solid bar; straightened, ground, cut or planed outside into an octagonal shape, the bore being left perfectly central. The length of this barrel, breech inclusive, when the muzzle is off, is 2 feet 8 inches, and the loading muzzle, to be in proportion, is as long as its outer diameter. The outside of the barrel tapers a little from breech to

muzzle, the difference in diameters being ¼th of an inch, and its weight is 10 pounds. It is indispensable that the barrels of target rifles be made of cast steel and not of iron.* The wear and tear of usage is hardly ever seen in a cast steel barrel fixed off with a patent muzzle, whereas, in an iron one it is soon perceptible, and its good shooting qualities quickly disappear. The barrel is not furnished with a rib, except the short tube at the breech end may be so called; the peculiarity of stocking precluding its use. The patent breech is made of wrought iron, case-hardened, and is joined to the break-off by the old fashioned hook, with the addition of a half-lap joint, secured by a square-headed screw, which is turned by the cone-driver. Such a mode of fastening the barrel to the stock does

* Rifle-makers ought to be very particular in the selection of good material for rifle barrels, for the market is flooded with cast steel which is inferior in grain and strength to wrought iron. The essential qualities of cast steel for a perfect rifle barrel, are smallness and evenness of grain on fracture, uniformity of texture throughout from end to end, and a moderate degree of carbonization. The Messrs. Remington, of Ilion, Herkimer County, N. Y., generally turn out very superior barrels both of wrought iron and cast steel.—*Author.*

away with the wood forward of the breech, and gives a peculiarly elegant and striking appearance to the weapon. The false or loading muzzle is put on by means of 4 steel wire pins, about ⅛th of an inch in diameter, and ⅝ths long, and the holes for these pins are drilled before the muzzle is cut off, and as near the outside as practicable. The muzzle piece is cut off, and the pins firmly fixed into it, and then held by a cramp to its place, when the rifling or cutting is done, by which a perfect fitting of the creases and bands at the junction of the muzzle with the barrel is secured. The bevel of the muzzle ought to be turned out in a lathe, to insure accuracy, and to this the attention of a good maker is particularly directed, for the perfection of the bevel affects the patching and the uniform filling of the creases with lead. A small globe of steel is fixed on the upper part of the muzzle to prevent the front sight being seen when the muzzle is on the barrel, so that there be no danger of firing it away. The bore of the barrel, in the first instance, is scant ⅝ths of an inch, or about 90 round bullets, or 43 pickets to the pound. It is then worked

out with lead and emery until it be parallel and round, and then cut with what is called a "Gaining Twist," starting at the breech at about one turn in 6 feet, and ending at the muzzle at one turn in 3 feet 6 inches. There are six cuts or creases, and the sides of the lands are cut square to their surface, giving a slightly dove-tailing appearance to the cuts. The cuts are not quite so wide as the lands, and great care is taken in cutting them of an uniform depth, which ought to be no more than will insure sufficient lead and patch for the firm holding of the bullet to the twist of the weapon. It is then what is technically called "freed" from the breech to within 1½ inches of the muzzle, so as materially to reduce the friction of the bullet and patch in passing out when the weapon is fired. The communications to the seat of the cone are free and open, and the breech furnished with a vent or breathing nipple, about the diameter of a common pin, and bushed with platina. The lock has back action, furnished with a single or French set, which I prefer to the English

or double set, I presume from education.* The guard is of a peculiar shape so as to allow the marksman to hold his weapon firmly. The stock is of black walnut, straight from the butt to the break-off, and there forms a considerable angle with the barrel.† It is furnished with a patch box of elegant shape, and a small box for the insertion of a wiper end, which screws into the ramrod, to be used in case of emergency. A globe sight is fixed into the stock just behind the break-off, and a bead sight at the muzzle end of the barrel. The front or bead sight (Figs. 1, 2, 3, Plate 3) is so called from its peculiarity of shape. A bead somewhat smaller than a pin's head is filed on a piece of steel wire, and the stalk left as flat and thin as practicable; this stands up about $\frac{3}{16}$ths of an inch from the barrel, and is shaded by a thimble about $\frac{8}{8}$ths of an inch in diameter and 1 inch long. The bead, stalk, and

* The single or French set is in general use throughout England for rifles and pistols.—*Author.*

† I have endeavored to prevail upon Mr. Wesson to give the stock less crook, being convinced from experiment, that a rifle with a very crooked stock *cannot* do as good shooting as it is otherwise capable of.—*Author.*

thimble are attached to a piece of bevelled steel, which is moved sideway for counteracting the wind by sliding along a dove-tail cut across the barrel about $\frac{1}{12}$th of an inch deep and $\frac{3}{8}$ths of an inch wide; a pointer filed on the front end of the thimble serves to denote how many divisions of the index the sight has been moved from the centre. This index (Fig. 4, Plate 3) is cut on the top of the barrel, and is left polished and divided into $\frac{1}{32}$ds of an inch. The globe sight (Figs. 5 and 6, Plate 3) at the breech end is made of steel, the top part being circular, with a small hole through the centre, countersunk on each side, to take away reflection. It is desirable that the centre of this hole be in the plane of the axis of the stalk, so that half turns may be used. One side of the stalk is flatted down with a file, so that the different ranges can be marked upon it. The stalk is cut with a thread of 64 turns to the inch, one turn corresponding to half a division on the front index. I shall in another place give the sketch and description of a new back sight, invented by me, which is vastly superior in all points, but more expensive than this. This

weapon is provided with a mahogany case, lined with velvet, in which all the necessary equipments of mould, swedge,* wiper, punch, nippers, and starter, are securely packed. The lowest price at which Mr. Wesson furnishes a rifle of this description with case, &c., complete, is $50, but I presume if fancy is to be consulted, it can be made to cost $200 and more.

CHAPTER II.

I SHALL now draw the reader's attention to a rifle made without a patent loading muzzle. To this the foregoing description will perfectly apply so far as every thing is concerned except the loading muzzle. In lieu of this the muzzle of the rifle is but slightly bevelled on the lands

* The word "swedge," although neither in Webster nor Walker, is very expressive, and in general use amongst blacksmiths and mechanics, both in this country and in England; and as a noun, means the tools used for giving any desired shape or figure to iron; as a verb, the act of "swedging" or giving the required shape to said iron.—*Author.*

only, just enough to allow as much lead and patch to enter the creases as is sufficient to keep the bullet to the twist when projected by the force of the powder. This is really but little, and much less in a freed bore with an increasing twist than in a parallel bore with a regular twist. This description of rifle is well adapted for hunting in the Western States and Texas, where long shots are of frequent occurrence. The barrels of all hunting and off-hand rifles should not weigh more than 8 pounds, when it is intended to use the globe sight. If the common open sight be exclusively used the barrel may be of any weight to suit the marksman. This is the best kind of weapon, in my opinion, for riflemen to use in war, and for that purpose the barrel must be of cast steel 2 feet 9 inches long, taper externally $\frac{8}{8}$ths of an inch from breech to muzzle, weigh 8 pounds, have a 70 to the pound calibre or about a half ounce picket, and charged with 2 inches of the bore of coarse powder, and a flat-ended picket, hardened with tin. The straight starter must be used, made of wood, armed with a brass ferule at the end, in order

to be light and firm, and attached to the belt or pouch by means of a leathern thong, so as to put aside all chance of losing it. A system of sighting may be used to great advantage, combined of the front silver, back crotch, and globe sights. The globe sight must be marked for the ranges, and provided with a hinge so as to lay down on the stock and be out of the way, when the open sight is required to be exclusively used. The men ought to be trained to use the globe sight at long ranges, from 250 to 1000 yards, for the express purpose of picking off artillerymen and horses, and reconnoitering parties; or for annoying columns under or forming for attack. Musketry at such distances is perfectly harmless, but every bullet from a rifle of this description, in well trained hands, would tell. For bush fighting the open sights must be exclusively used, indeed in all cases where a quick sight is requisite. The only objection that can be made to this weapon is the time required to load it, for it cannot be loaded as quick as a common rifle, with a round bullet; but when it is loaded, the superior accuracy

are in all respects generally similar to the rifle first described, in construction, finish, and sighting, with the exception that the calibre is smaller, ranging from 140 to 200 to the pound, and the twist quick in proportion. The outside diameter of the barrel is generally about 1 inch, octagonal and parallel. The charge of powder is about 1⅛ inch of the bore or nearly 5 calibres, and it ought to be stronger than that used in the long rifles. The calibres of these weapons ought to be proportioned to the distance at which you wish them to perform best, and in this they obey the same laws as a long rifle. This weapon is also furnished with a case of mahogany, lined with velvet, and having apartments for the moulds, swedges, &c. The performances of this pistol are astonishing, and more so to those who are prejudiced in favor of long barrels and heavy calibres. I think it will be sufficient to convince any reasonable man, on inspecting target No. 5, made by me with this weapon, that I can beat at any distance any 4 feet barreled western hunting rifle ever made and used on the old system.

Rifle Illustrations.

Full size.

Fig. 1.

Fig. 2.

Fig. 5.

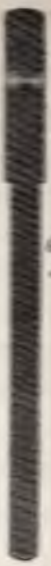


Fig. 6.

Globe Sights.

Rear Sight.

Fig. 3.

Indian. Fig. 4.

Fig. 7.

Fig. 9.

Fig. 10.

Telescope Movements.

Fig. 8.

Fig. 11.

G. R. W. Endicott L

Having described all the weapons requisite for the use of the marksman and hunter, and thrown out some hints as to the use of the *flat-ended picket with heavy charges of powder*, as a weapon of war, I shall now proceed to describe such improvements in sighting which I have lately effected by the introduction of a telescopic sight and movements connected therewith, which will perform perfect at all times. A view of this instrument is shown in Fig. 2, Plate 2, attached to a rifle. The tube in which the lenses are fixed is 3 feet 1 inch long, §ths of an inch diameter outside, and $\frac{1}{20}$th of an inch thick, weighing about 10 ounces. It can be made very good and stiff from sheet-iron, brazed at the joint, floated and leaded out true; however, sheet-steel is preferable. To the front end a saddle of steel (Figs. 10 and 11, Plate 3,) is firmly fitted and brazed; and a narrow flat rib is soldered over the brazed joint of the tube, the object to be attained being stiffness combined with lightness; for when fixed on the rifle, a discharge has the tendency to pitch it forward, and break out the dovetail or neck off the pivot screws;

and this tendency increases as the charge of powder increases. A carriage is made to slide through the bead sight dovetail, furnished with two standards, through which two screws pass into the saddle, serving as axes or pivots of elevation or depression. The back movement for elevating or depressing without taking out the telescope, is shown in Figs. 7 and 8, Plate 3, and is designed to adapt itself for all ranges, keeping the charge of powder and the sighting always alike, a property which the common globe sight does not possess; for with it no nearer approach can be made than half turns, and I have never seen one work truly with half turns; consequently, you cannot work nearer than one turn. It is also used as a globe sight, by the insertion of a piece of circular steel (Fig. 9, Plate 3), with a hole in it.

All my best rifles are fixed off in this manner, so that either a telescope or globe sight can be used with very little trouble, for the front movement of the telescope works in the same dovetail as the bead sight does, and the back movements serve, as I have just described, for a globe sight. I am aware that

telescopes have been in use for some time, but to my cost, I know that they never did perform so well as the globe sight, until made and used as above described, and which I once thought of securing by a patent, but found that the trouble and expense would overbalance the profit. The old telescopes were universally shorter than the barrels, and set into them by a dovetail not far from the breech of the charge; their movements very unmechanical, proving fruitful sources of error alone. It is evident to any geometrician, that whatever degree of variation these short telescopes are liable to, such variation *must be reduced* in the inverse ratio of their lengths, when long ones are used, supposing a like variation in each case, which I am not willing to allow; for from several reasons, and from practical experiment, I know there will be more motion in the short telescope than in the long one; and I also know that so far as sighting is concerned, this telescope, properly made and properly fixed, is nearer perfection than any other method of sighting known. The cause of the greatest errors arising from the use of

the short telescope, is sighting through a heated atmosphere, radiated and refracted from the surface of the barrel in front of the object glass; and the higher the range the greater the aggravation, for the axis of the telescope necessarily forms a greater angle with the surface of the barrel at long than at short ranges; and this cause of error is completely obviated by the use of the long telescope. It may not be improper here to say that such liability to error exists in the use of the globe sight, which may be observed any time by firing quickly in succession, and producing greater temperature in the barrel than there is in the surrounding atmosphere.* The act of giving out heat to the adjacent air produces a dancing motion, and consequently a distorted me-

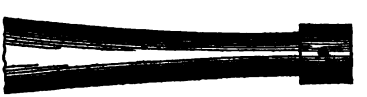
* There exists at times a good deal of refraction in the atmosphere, especially on a sunny day, when the ground is covered with snow. At such times, it is advisable to have the line of sight, consequently the object aimed at, and the rest, as far from the surface of the snow as practicable. If this refraction were caused from a level plane of snow, the bullets would strike the target higher than usual; but the surface being always uneven, the tendency for the bullets to scatter in a large circle is easily accounted for.—*Author.*

dium, which may be observed by looking at any object through the atmosphere along side of a stove-pipe or a brick-kiln. In the formation of this telescope, the single lens, the negative or double lens, or the erecting eye-pieces, may be used without any apparent advantage over one another. The two first invert the object, and for this reason are a sad puzzle in the hands of a new beginner. The erecting eye-piece is the best adapted for general use, as nine people out of ten are very inexpert in seeing an object through a telescope of any description, much less qualified to *sight* through an inverting one. These target telescopes are made by Morgan James, rifle maker, Utica, N. Y., and with front and back movements cost about 20 dollars. A pair of cross hairs are fixed in this telescope for the purpose of sighting at a mark, and are fastened on a new plan invented by James, which cannot be affected by the vibration of the weapon, and particular attention is paid to the *seating of the lenses*, and the fastening and fitting of the tubes in which they are set, to the tube of the telescope.

CHAPTER IV.

HAVING given a description of such weapons and modes of sighting as are most advanced towards perfection, I shall next proceed to notice the necessary equipments used for the purpose of cleaning, loading, and making up the ammunition in the manner now in use, and believed to be equally in advance with the weapon. The first article is the

WIPER.—This is generally made of hickory, straight grained and clean, but toughness is not indispensable in a wiper for a target rifle. A wiper with a joint in it (so as to be packed up in the case) is generally sent out with a first rate weapon, and this may be used occasionally, but I advise all marksmen to have a rod without a joint in it, about 4 inches longer than, and its diameter nearly as large as the bore of the rifle, the wiping end being cut into the annexed shape and armed with a brass ferule for



the purpose of preventing the cleaning rags

from slipping off when worked up and down. The other end being of this shape for the ex-  press purpose of placing the bullet home, after being started. A wiper should be kept as straight and clean and free from gritty dust as possible, and I am of opinion that when out of use it is not good policy to leave it in the bore of the weapon.

WIPING RAGS.—These ought to be made out of a fabric called cotton flannel, which can be purchased at the stores for 12½ cents per yard. You will require 100 rags, cut uniformly about two inches square, and these will be sufficient for 100 shots; and after use, must be washed out clean and then dried, taking care not to get any grit or coal dust mixed up with them. The wiper end of the rod must be of a size proper for the free working of these rags up and down the bore of the weapon.

CHARGER.—This is generally made of a brass tube of the same diameter as the bore

of the barrel, 2½ inches long, furnished with a wooden stopple, upon which is marked the charge proper for the rifle it is intended to accompany. As a *measure of weight* it is sufficiently accurate for general performance, but when the utmost nicety is requisite, the charge of powder must be weighed in a pair of delicate balances and put into tin or brass tubes closed up with nicely fitted stopples.

Powder.—Powder for the use of the best target rifles is furnished by Mr. E. Wesson, and is made under his direction expressly for that purpose by the American Powder Company, in the neighborhood of Boston. Its characteristics have been mildness, moderate strength, *evenness in size of grain*, and the residuum, considered by chemists to be a sulphuret of potash, very soluble in water, thus requiring the introduction of a very small quantity of moisture into the breech part of the bore of the rifle. English rag, Dupont's, and other strong, quick firing powders, in which the component parts are very pure, do not work well in these particular rifles. The

grains of powder appear to ignite too rapidly, and the residuum cakes very hard upon the bore at the breech end, requiring much wet to loosen it, an evil to be avoided if possible. In fact, these descriptions of powders are *too good and strong* for the *perfect use* of the improved rifle, a fact, I believe, not generally known. I may here state that some powder, after being kept for a time, appears to lose its strength very perceptibly, and its original color turns to a dingy brown. The presumption is, that one of the ingredients of such powder is nitrate of soda, in place of the nitrate of potassia (saltpetre). Powder so compounded must be kept air-tight, otherwise part of its composition will be absorbed and carried off by the atmosphere, and more quickly so when kept alternately damp and dry. The composition of powder appears to have been known to the Chinese centuries before it found its way into Europe, through Arabia and Spain;* but if we may

* Gunpowder, the discovery of which is generally attributed to Schwartz, a German chemist, was known to the Arabs at least a century before any traces of it appear in European history. Though it is probable they may have derived their know-

judge from the sorry exhibition of gunnery they lately displayed when opposed by the "red-headed barbarians," the doctrine of progression can find but little support in the Celestial Empire.

BULLETS.—These are cast in a pair of brass moulds of "various quaint devices," one of the most eligible of which is shown in Figs. 1 and 2, Plate 4. Some weapons require the lead to be hardened, whilst others seem to perform the best with the very softest. The cause of this I am not thoroughly master of; but, as a general rule, rifles cut with deep creases, and much freed, require the soft lead, and those cut shallow and moderately freed, the hard. I have generally found that lead, after being shot against the target, and afterwards melted up carefully, has become harder, and hard enough for most rifles; but in some cases it is neces-

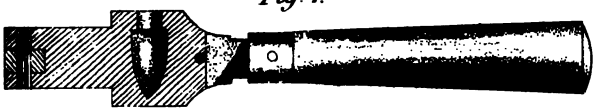
ledge of this composition from the Indians, they certainly improved its preparation, and found out different ways of employing it in war.—*Crichton's Hist. Arabia.*

It is also presumptive that the Indians who opposed Alexander the Great, in Asia, were aware of the composition of gunpowder, but not of its propellant power as an engine of war.—*Author.*

RIFLE EQUIPMENTS.

½ of full size.

Fig. 1.



Bullet Mould.

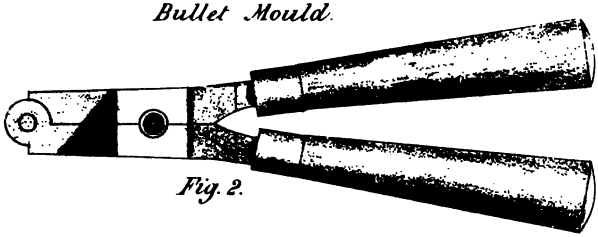


Fig. 2.

Fig. 3.

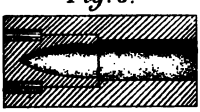


Fig. 4.

Swedge.

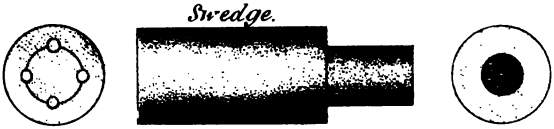


Fig. 5.

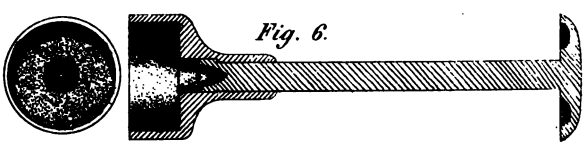


Fig. 6.

Guide Starter.

Fig. 7.

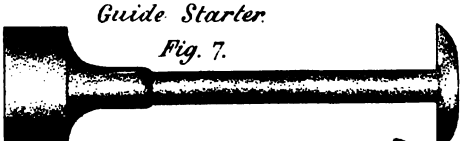
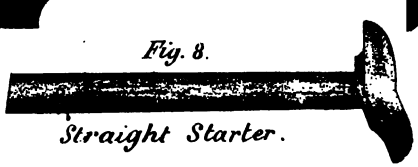


Fig. 8.



Straight Starter.

sary to use hard lead, which may be made either by an admixture of tin, antimony, bismuth, or old type metal. I use the former, and put into a small kettle 4 pounds of soft lead, and ¼th of an ounce of grain tin, heating it nearly red hot, skimming off the dirt from the surface as it rises, pouring it into a flat vessel, so as to leave the sheet about half an inch thick, and then cutting it into pieces to suit the size of the ladle. Most rifles made upon the improved system, but without false muzzles, are cut shallow, and in them the use of hard lead is generally indispensable. Some marksmen are in the habit of smoking the interior of the mould over a lamp, a method I do not approve of. I prefer to have the mould as clean as possible, and take great care to keep the surfaces of contact clean, and free from flakes of lead, which are very apt to adhere to brass; especially when using lead hardened with tin. Too much lead must not be melted in the ladle at one time, and the mould must be held at a certain angle, some greater than others; otherwise you will have an imperfect bullet, caused by the lead rebounding from the bot-

tom of the mould to the top, and then becoming hard before the remainder of the lead in mass reaches it, and such imperfections are commonly called "screws." Bullets so disfigured must never be used, and indeed the whole of the "cast" must be carefully examined over, and the scant and misshapen bullets put back into the ladle. Pig lead is the softest and most free from admixture with old lead and solder, so likely to be discovered in the bar lead sold at the stores, McCullough's excepted, which I have always found to be very soft and even in composition. If bar lead be used, it is policy to melt up eight or ten in a kettle, and pour it out into a flat mould, &c., and by so doing you guard against the possibility of shooting lead of five or six different degrees of hardness; but such precaution is only necessary when you wish to do your best, and have to put forth all you know. After the leads are cast and examined over, the next process is to cut off the "sprews," with a pair of nippers, and this must be carefully done, if you wish the bullets to balance evenly. After putting them into a small bag with a few

drops of oil, and working them about so as to coat them evenly over, they may then be swedged, balanced and put into the bullet-rack.

CAPS.—It is obvious that the weaker the detonating charge of the cap be, the better, provided it have heat enough to ignite the powder at the bottom of the cone, and on this account alone I use the French caps G D split and ribbed, in preference to the English sporting caps. They can be purchased in New York at about fifty cents per thousand, and when genuine are better adapted for fine target practice than any other with which I am acquainted. For hunting deer and other large game, I use and recommend the heavy English cap, which, after being waterproofed with shellac varnish, and properly fixed upon the cone with deer's tallow, will stand the "damper" of a Scotch mist, and then explode. A hunting rifle ought never to be made with a vent; for misty, rainy weather is certain to damp the powder in the breech; furthermore, there is considerable art in putting on a waterproof cap so that the powder shall not get

damp along the passage of the cone and hinder ignition, although the detonating powder in the cap may be dry and explode.

It is evident that the quieter we can keep the act of communicating fire to the charge, the more perfect will be the holding, and the greater the chances of having all the charges fired alike; and if any one can scheme a method of firing the charge without blows and vibration, he will undoubtedly benefit himself, and confer an obligation upon all first rate rifle shooters.

CHAPTER V.

SWEDGE.—This tool has been introduced into general use about three years, and first appeared with the Wesson rifle, although I find that other makers have made them at times previous, and of various constructions, but Mr. E. Wesson claims the method practiced by himself. Figs. 3, 4, and 5, Plate 4, show the manner of its construction by Morgan James, following the general form as

originally made by Wesson, but differing in the mode of making it. A piece of a rifle barrel is taken, about 2 inches long and of a bore somewhat larger than the bullet you wish to swedge, and countersunk down at one end far enough for the admission of a piece of steel truly turned and fitted to it, the form of the bullet being turned out and polished at the inner end of it. This piece is retained firmly in that position by four small screws set tightly into the joint of the piece of barrel and the piece of steel, parallel to the longitudinal axis of the swedge, and then filed off level and sightly. A steel stamper of the form shown in Fig. 4, is made to fit the bore of the swedge, and its end turned up true, and of the form desired for the butt of the bullet. The unelasticity of lead is familiar to most people; and upon this property of the metal, combined with its softness, may the complete success of this simple and beautiful tool be ascribed. In construction we can approach nearer to the true form of the circle than any other figure, and this being a series of circles throughout, *and if made by a good mechan*

in a good lathe, will be more perfect than the starter, as that is liable to get out of order from accidental blows; and probably is nearer perfection than any part of a rifle or its equipments. The use of this tool is obvious. A bullet, when oiled as above described, is taken and put point downwards into the bore of the swedge, the stamper is then placed upon it and struck smartly two or three times with a light hammer weighing about 6 ounces. The exact strength of each stroke must be determined by practice, for the employment of too much force raises up a burr edge, and too little does not fill up the swedge at the butt of the bullet. After being swedged, the bullets must be carefully balanced in a pair of small scales, kept for that purpose, and then put into the rack of the ammunition box.

PATCHES.—These must be cut with a punch of the kind used for cutting wads for shot guns, hardened and tempered and ground up to a fine edge. It is advisable to double up the linen so as not to cut more than eight patches at one time, otherwise they will not

be of an uniform shape and size. For fine target practice you do well to use the best *brown* Irish linen, the price of which is about 50 cents per yard. Some rifles require finer linen than others, but I prefer fine brown linen to white, for the bleaching is generally done with acids, which in a degree destroy the strength and sharpness of the linen. I shall here give a rule which will apply for proportioning the size of the patch to the flat-ended picket bullet from ¼ to ½ inch bores, simply observing that it is safer to have the patch too large than too small. "*The diameter of the patch, consequently the punch, must be twice the diameter of the butt of the bullet.*"

STARTER.—This improvement is made of different shapes and substances, but after a great deal of experience in all weathers, I prefer the one shown in Figs. 6 and 7, Plate 4, and which is manufactured by Morgan James, of Utica. It is made of brass throughout. The straight starter works through a guide socket about 1½ inches long, but a lip at the end, striking against the countersi

at the lower end of the guide, prevents them from separating. The large hollow socket is turned out true and square with the guide socket, and fits over the loading muzzle, which for that purpose is turned up true with its bore.

Fig. 8, Plate 4, shows the form of a common straight starter, which is used when accuracy must be sacrificed to portability and convenience, as is the case in hunting and war. It may be made of brass, or wood with a brass ferule; I prefer the latter, because it is lighter and less liable to injury.

Having described the equipments directly connected with the weapon, I shall now proceed to give the reader a sketch of such furniture as I am in the habit of using, although their particular adoption is not essential to ensure good performance. The first that claims attention is the box in which the ammunition and equipments are carried. Figs. 4 and 5, Plate 5, show a plan of one I use. In the compartment A, I put a small brass hammer, for the purpose of moving the front sights, nailing on targets, &c., a screw-driver,

a two-feet rule, a pair of compasses with pencil leg, for describing circular targets, a cone-driver, charger, and starter, the end of which is protected by a pine wood cap. In B, I put a paper of small tacks for the purpose of nailing on the target papers; in C, two racks or cases of bullets of the form shown by Figs. 2 and 3, (the lower part is of wood in which 60 holes are made of the form of the bullet, and in which they are placed after being swedged and balanced; the cap is of tin, lined with cloth.) In D, the powder flask finds a location, and in E, a tin box of caps, and another of patches. The box and divisions are lined with cloth throughout. Some marksmen have more costly and complicated boxes, but in this there is convenience enough for one day's sport, and its cost will not exceed two dollars, if made of Walnut or Mahogany.

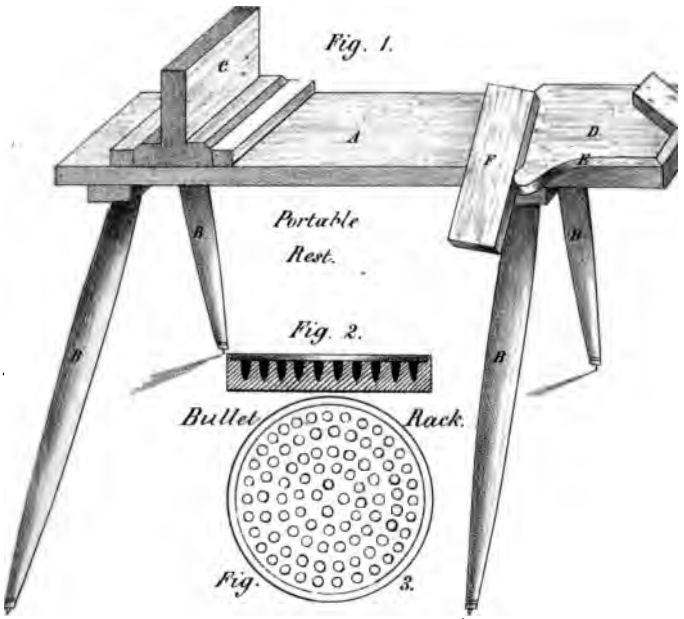
The next article to be considered is the rest. I will here state that for first rate shooting, a good firm rest is indispensable, for performances made from logs, stumps, rails, and fences are generally very inferior. Of what use is it to carry out all the *niceties in working* th

weapon, if you spoil the whole by using a false and crazy rest? As this work is not likely always to fall into the hands of careful men, I think it best to speak out and give such advice as young beginners and slovenly practitioners may profit by. Of what use, I say, is an elegant and costly and good performing weapon, in the hands of a man, who does not know from ignorance, or neglects from carelessness, how to use it and bring forth its good qualities and best performances? About as much as providing an alligator with a snuff-box!

I shall describe a portable rest which I am in the habit of using, and leave it for the marksman to imitate or make any alterations he may fancy. Fig. 1, Plate 5, is a perspective view of this contrivance. A is a plank of hard wood 4 feet 6 inches long, 10 inches wide, and 2 inches thick. B B B B are 4 legs of maple turned round, 1½ inches diameter at the ends, and 2 inches at the swell, and 3 feet long, which ship into the bench plank, A, through circular holes cut for that purpose on the bevel, the legs splaying out

RIFLE EQUIPMENTS.

Fig. 1.

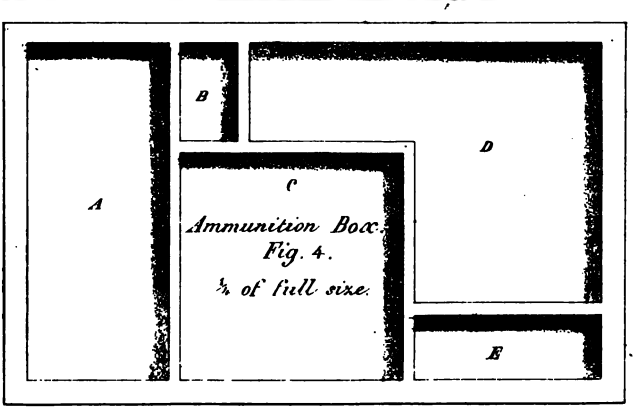


Portable Rest.

Fig. 2.

Bullet Rack.

Fig. 3.



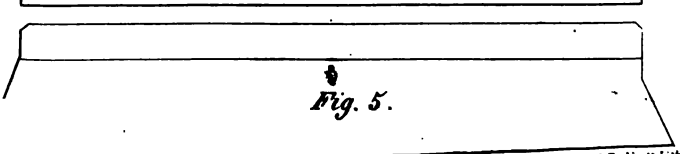


Fig. 5.

G. & W. Endicott Lith

sideways, so that the top of the bench is 2 feet 9 inches high. C is a piece of pine or other soft wood, as long as the bench is wide, 9 inches high, 2 inches thick at the top, and 6 inches at the base, nailed down to the bench A, having nicks cut into it, covered with cloth to prevent vibration, for the rifle to rest in. This must be set on the bench so that when the marksman is at rest, the first thimble of the barrel will just reach it. D, is a piece of 1 inch pine board nailed on the bench, A, and cut into a shape at E, to suit the marksman's breast, and having a piece, F, of inch board 6 inches long, and 3 inches wide, nailed to it and the bench plank at a proper angle, where the left fore-arm and fingers rest, and another piece, G, of the same dimensions, on which the right elbow and fore-arm rest, the right top-arm forming a cushion against which the butt of the rifle recoils. I have seen a great many rests, but never one to equal this for convenience, fitness, and firmness. If it be desirable to make it permanent, the legs may be square and mortised into the bench, and stiffened with braces.

In target practice, first rate marksmen generally use flags, as indicators of the direction, strength, and variation of the wind. They are commonly made of twilled cotton cloth, white or black as the seasons require, 6 feet long, and 2 inches wide, hemmed at both edges, and fastened to the top of poles 7 feet high, and placed from the marksman to the target at every 10 rods distance. Upon the correct observation of these flags, and proper application of their indication, depend the finest touches in the performances of the rifle; and nothing but practice, combined with good judgment and memory, will ensure them, and in some states of the wind these do not always avail.

When using a globe sight, the size of the target ring of white drawing paper must be of a diameter to suit the distance of the target, the size of the bead sight, the strength of the marksman's eye, and the clearness of the atmosphere. On a bright clear day at the distance of 40 rods, with a bead of moderate size, the target ring may be 7½ inches diameter. On a dull day, at the same distance, a ring 9½ inches in diameter may possibly be required. At the

distance of 80 rods a white target from 12 to 16 inches diameter will be required, and at 100 rods from 15 to 18 inches. These white targets must be nailed with "Tacks" to the centre of the wooden target, the face of which has previously been covered over with a dark non-reflecting substance, such as black or brown cloth, a mixture of soft soap and lamp-black, common mud, blue or green paper, and an "endless variety," as the flat-catchers say, "too numerous to mention." I prefer something that can be put on and taken off pretty often; and as cloth, although the best, is too expensive for every day work, I use either plain blue or green paper, which can be purchased at the paper-hanging retailers at 12½ cents per roll. The size of the wooden target may be about 18 inches square at 20 rods, 2 feet at 30, 3 feet at 40, 4 feet at 60, 5 feet at 80, and 6 feet at 100 rods, and made of ½ inch bass or other soft wood, nailed upon two legs of hard wood of sufficient size to be in proportion with the target. These legs ought to be placed near the extreme edges of the target, and project 1 inch at top, and 18

inches at bottom, sharpened so as to penetrate the soil. By striking on the upper projections of the legs, the target will be generally fixed sufficiently firm, but if the wind be very rough, light props to the outer edges must be used, for if placed near the centre they will be cut away by the bullets. If the direction of your shooting be liable to be crossed by people or cattle, it is advisable to have a barricade of clay or stone 2 feet 6 inches thick, and as large as the target,* without such precaution you may unexpectedly find yourself in the claws of the law, or have at least a fall of "cow beef," which will be any thing but pleasant either to the feelings or the pocket.

A refracting telescope of considerable power is requisite to observe the bullet holes in the target, making the marksman independent of the marker. These can generally be purchased at from 10 to 20 dollars each, although the one I use cost 45 dollars, made by Lere-

* A cubical box made of hemlock boards 18 inches long on the side, and filled with raw cotton, is a most excellent receptacle for the bullets; the trouble of occasionally taking out the cotton is paid for by the recovery of all the leads.—*Author.*

bours of Paris, with a power of 77 times, and is beautifully clear, with which at 40 rods a pin's head may be seen. The Messrs. Pike of New-York generally have on hand some excellent French telescopes, from 16 to 20 dollars each.

PART SECOND.

ON THE PRACTICAL MANIPULATION OF THE IMPROVED AMERICAN RIFLE AT REST AND OFF-HAND TARGET PRACTICE.

CHAPTER I.

THE requisites for making a *good marksman* are possessed by the majority of men. It is not indispensable that a man's nerves be of iron, his front like Jove, his eyesight piercing as the eagle, his action quick as lightning; no—this is the "poetry" of the art, but not the "naked truth." I have seen men whose nerves were very much diseased, others whose eyesight was only moderately strong, others whose judgment was very slow and uncertain, and whose motions were any thing but quick, and all of them do good shooting. But I am of opinion there are but few men qualified by nature and practice to bring forth at all times the highest qualities of the weapon, by putting on the "finishing touches" of the art.

For off-hand performances the requisites are more imperative; a good eye, good judg-

ment, concentrated action, and if no extraneous support be used, a vigorous frame, are all needed. Cooper, in the beautiful tales of the "Pathfinder" and the "Deerslayer," makes his hero "Leatherstocking" perform and brag a "leetle" too much. The knack of driving common nails, off-hand, at 100 yards distance, and of pinning the war-lock of a chief to a tree at 200 yards, are more than the matter-of-fact people of the present day can be made to believe. "Killdeer," the gift of the beautiful but coquetish Judith, must have been "a very" "oncommon weapon," and I should not stick at making a pilgrimage, barefoot and on thorns, if Mr. Cooper, in any of his future tales, *will interpret the writing on the stock*, and let us know where the saintly relics are now reposing. I tremble at the thought of disturbing the faith of the simple and enthusiastic, but these feats and boasts of "Hawk-eye" have cost me a great deal of time and money, in proving that the rifle cannot be made, nor the man produced, to do such "heavenly execution."* The feat of hitting

* The perusal, when a boy, of some of Cooper's Tales, espe-

a potato, when thrown up into the air, with a rifle bullet, is not "uncommon," and I can "do some" at that game; but there is no dead certainty in this, for the least hang in the firing of the charge will inevitably compel you to miss. If this should meet the eye of any of our "dreamy writers," who may happen not to know quite as much about the "beautiful weapon," as Mr. Cooper appears to, I hope it may have the effect of preventing them from "gilding gold," or "painting the butterfly;" the actual performance of the rifle is startling enough, without being smothered in romance or drowned in fiction.

I shall now take the young marksman to the rest, and consider he has the target up at 40 rods distance, and going to use a target rifle of the best description, his flags at every 10 rods, his wits and self-possession at his

cially the "Last of the Mohicans," gave the first bias to the author's mind, and induced him to study the construction and use of the rifle, and fired his soul with the expectancy of beholding the red man and his lovely, lonely wilderness. Alas! the duration of both, on this continent, is but short; and many white men of the next generation will depart without seeing the "image of God" in the form of the wild child of the wilderness.

fingers' ends. The first manipulation to be performed, is to force with a wiping rag all the oil out of the barrel that you can, take out the cone, clean it and the passages, insert some loose powder into the cone seat, screw in the cone, and fire it off. This will drive out the oil and dirt left in the communication of the breech from the last day's practice. Take the charger, and after carefully measuring out the proper quantity of powder, pour it slowly into the muzzle of the weapon, keeping the barrel upright; take the patch and wet it thoroughly in your mouth, put it on the centre of the muzzle, upon it place the bullet and seat it firm and true with your finger and thumb, then apply the starter, and after giving it two light taps with the palm of your right hand to start the bullet true, give it two more and send it down as far as the starter reaches; then take the wiper and push down the bullet carefully and slowly upon the powder. Take off the muzzle, put on the cap, place the weapon on the rest, sit down, cock, and set the trigger, place the butt-plate square against the upper part of the top-arm muscle, bring

the right hand to the grip and back guard, whilst with the left take firm hold of the front guard, keeping, with both, the weapon tight to the shoulder, and "*firm sideways*," but do not press the muzzle end down on the rest, for its own weight ought to be sufficient to ensure it not jumping when fired off; observe that the front sight be upright, and seeing the bead sight through the centre of the globe sight, place the bead itself upon the centre of the white target, observe the flags, pull the trigger, and if all is rightly and properly done, the shot will be all right also. If, however, after firing three or four shots, the centre of the shooting be too low or too high, to the right or to the left, regulate the back sight for the former, by elevating or depressing, and for the latter by knocking the front sight to one side or other, as the case may require. This part of the manipulation to young beginners is very troublesome, as it exacts more thought than they are generally willing to bestow, or have any idea the case absolutely requires. I wish to impress upon the young marksman the necessity of mastering this department of the art

as quickly as possible, so as to be able at once, after three trial shots, to put the centre of the shooting into the centre of the target. To accomplish this, it is necessary to have a table calculated, showing the variation sideway which one division of the front sight index effects, and the distance which one turn of the back sight elevates or depresses, and at all ranges most likely to be used in practice. I will give an example for the sake of elucidation only, for it is not likely that the distance between sights will suit for any other rifle. Supposing you are practising at 40 rods, or 220 yards, and that the back and front sights are three feet apart, it is evident, the front sight index being divided into $\frac{1}{32}$ds of an inch, that when the front sight is knocked one division or $\frac{1}{32}$d of an inch sideway from where it was when the last shot was made, it will, when the weapon is fired again, make a continued deviation sideway of $\frac{1}{32}$d of an inch in every three feet the bullet is projected, and at 220 yards will produce $220 \times \frac{1}{32} = 6\frac{7}{8}$ inches. Also, under similar circumstances, one turn of the back sight of a 64 to the inch thread, pro-

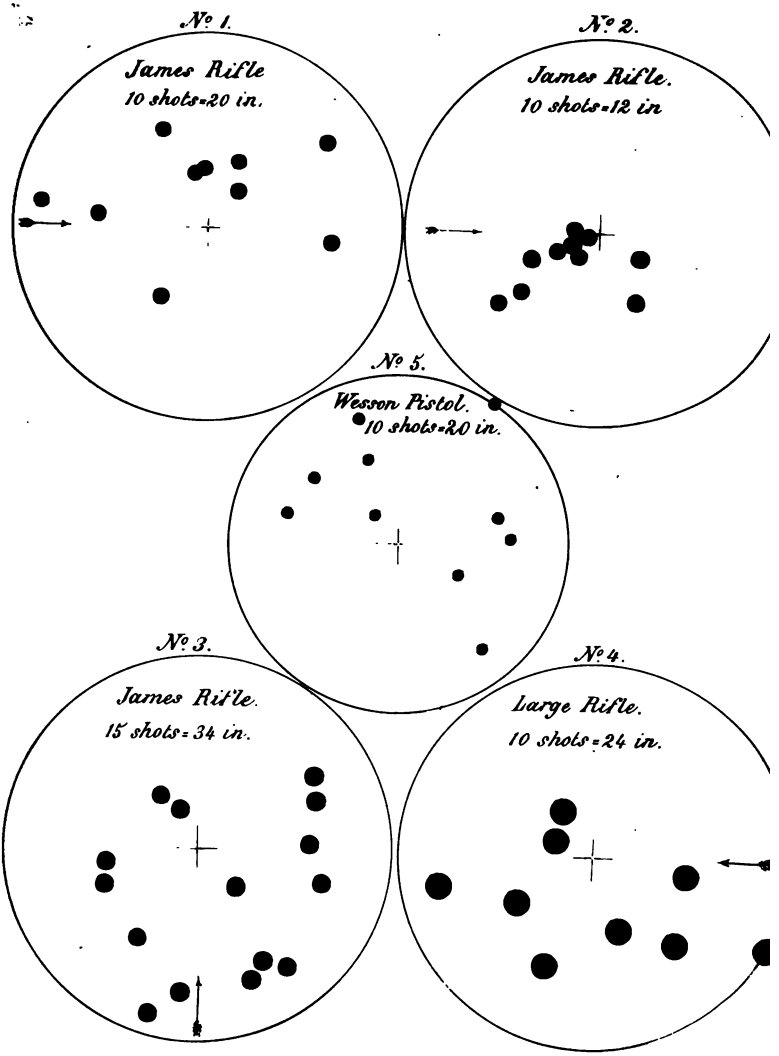
duces $\frac{1}{64}$th of an inch in every three feet, consequently one turn makes a difference of 220 $\times\frac{1}{64}=3\frac{1}{2}$ inches, less $\frac{1}{16}$. A marksman knowing this, will, if the first three trial shots strike seven inches too low and seven inches sideway, turn up the back sight two turns, and knock the front sight sideway one division, keeping in mind that if you want a bullet to strike the target to the left of the last shot, knock the front sight sideway to the right; and if you want it to strike to the right, knock the sight to the left. This is obvious to any one of geometrical acquirements, although I have seen men of education at a loss where a backwoodsman never errs.

CHAPTER II.

When the wind blows very strong, it will at the same time generally puff in streaks or gusts, and in shooting in such weather the nicest judgment and attention are requisite in order to keep the bullets together; and in spite of every thing, the best marksman can-

not always succeed, and occasionally a wild shot is made. This results from the bullet acquiring a new direction from striking against a gust or streak of wind, which it keeps throughout the length of its flight, in addition to the action of the general strength of the wind; and it is evident the nearer the commencement of its flight that such new direction takes place, the greater will be the variation at the target; and for this in particular, and windy, flawy weather in general, it is necessary to watch the flags nearest the rest, with greater care and attention than those nearest the target. Some marksmen prefer to get the shooting of the weapon central with the target, and keep firing away, merely using the flags as indicators of any change in the direction of the wind, or any very sensible addition to or diminution of its strength, and not caring to be particular in watching the smaller variations. In general, such marksmen have better eyes than judgment, and in a side wind their performances are pretty well "*up and down*," but are necessarily deficient, "*sideways*." The target

TARGETS
at 220 Yds.
¼ of full size.



et del.

G. & W. Endicott Lith.

No. 1, Plate 6, was made by me under such an inferior mode of practising; and although a moderate performance, does not equal the more studied and careful manipulation displayed in No. 2. No. 3 was made with the wind blowing directly the same way as the bullets flew, and shows very distinctly the causes of variation when the wind is sideway, for a streak or gust, which, in shooting down wind, had strength sufficient to force up the bullets to the top in No. 3, would, if shooting across the wind, have driven them across to the right, as in No 1. These targets were made with a rifle of 90 to the pound calibre, made by M. James, of Utica. Target No. 4 was made at the same distance with a rifle the barrel of which weighs 33 pounds, and $\frac{1}{2}$ inch or 38 to the pound calibre, and carrying an ounce picket bullet, with five calibres of powder. Target No. 5 was made with a 12 inch Wesson pistol, in a favorable time, at the same distance. It is evident from the appearance of these targets, that, at 40 rods distance, the two last named weapons are no match for the first; and this arises from the impossibility of

giving their bullets as much velocity, in proportion to their surfaces, as the first, which may be understood by consulting the part on "Theoretic Principles." Target No. 6 was made with my Tally-Ho Wesson rifle, with telescopic sights, and is the best ten shot string at 40 rods that I ever made, measuring only 11 inches centre and centre. I have made ten successive shots at 40 rods much closer together, but never succeeded in getting a string to look or measure better than this. Target No. 7 was made by Captain W. Tisdale, of Utica, with one of James's muzzled rifles, using telescopic sights, and measures 9§ inches centre and centre, and is the shortest ten shot string at 40 rods that I ever *knew* made. Such is the progression of knowledge and art!

The marksman when down at the rest must study to put himself into a position perfectly at ease, but not too loose; he must hold his weapon firm, but not tight enough to strain his muscles. He must not fire too quickly after being seated, but take especial note of the indication of the flags with regard to their

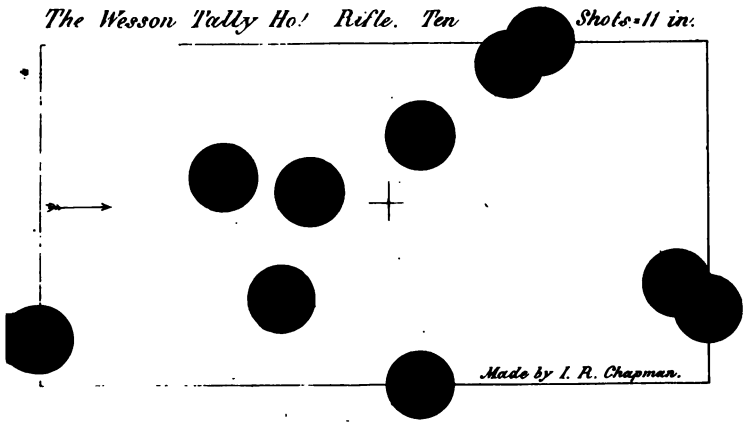
TARGETS

at 220 Yds.

full size.

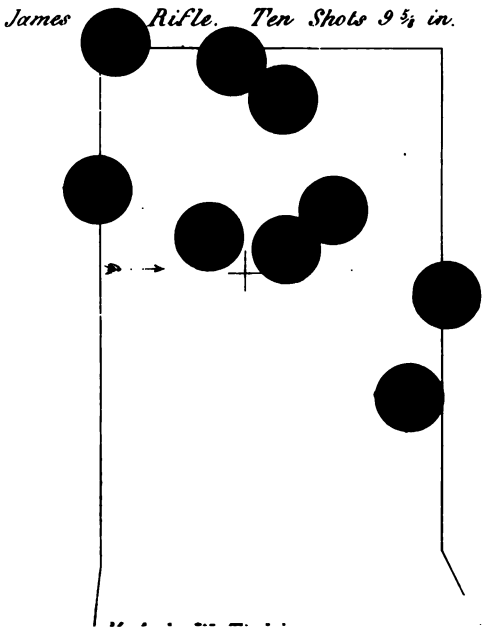
No. 6.

The Wesson Tally Ho! Rifle. Ten Shots 11 in.



No. 7.

James Rifle. Ten Shots 9 5/8 in.



comparative state with the last shot, and their general appearance indicative of a change in the direction, or a general increase or diminution in strength, and not fire until he feels confident that his observations and deductions are correct. To be a finished performer he must not wait until the flags are exactly in the same state as they were when he commenced the string; he may wait for an hour and this perhaps will not take place. The plan I adopt, is to avoid all the heavy gusts and streaks as much as possible, and fire in the intervals when the wind is more moderate, forming my judgment from a comparison of the then state of the wind as indicated by the flags, with its state at, and effect on, the last shot. If the wind be uniformly stronger, I hold as much into it as, from practice and knowledge of the particular weapon I am using, I know is sufficient, preferring to hold too little rather than too much. If the wind be weaker, I hold down wind, my judgment based upon the like perceptions. When using a globe and bead sight, I never dare place the bead out of the centre of the target, but "*cant*" the

weapon over sideway, so that the top of the bead sight is inclined towards that side to which I wish the bullet to be projected. This is dangerous work for a new beginner, and he must not pursue such a course until he can tell tolerably well, at a glance, whether the front sight be really upright or not. As simple as this may appear, it troubles nine out of ten to accomplish, and they "*cant*" their weapons over to one side or other very considerably; and if they keep it all the time at the same angle and at the same side, it is not of much consequence. However, knowing that such manner of holding a rifle is not proper, I beg to caution those who are not aware of the causes of bad side shooting, against doing so; for this, combined with not having the centre of the bead on the centre of the target, but somewhere around it, produces such bad performances, which are generally ascribed to the slow shooting of the weapon; a simple misapplication, putting upon the back of a "*deaf*," I was going to say "*dumb*" "*critter*," faults which ought to be borne on their own.

I shall now proceed to give the young marks-

man some instructions in what I consider to be the most desirable and manly way of using a rifle, that is, at "off-hand." I consider that when we say "*off-hand*," we ought to mean that the marksman shall use nothing except himself and his weapon, and with them only form his rest as he pleases; having a perfect right to stand up and off-hand clean, hip, or rib his elbow, but he must not bring in and use any extraneous help, such as wipers, ramrods, sticks, or come the "*Mississipi dodge*" by having a jointed rest attached to his body, and running along his left arm, and by a simple movement making it as stiff as if mesmerized or case-hardened. No; such "*legisms*" do not come under the fair term "*off-hand*," and I shall treat only of the art as produced by a fair, clean off-hand operation. For this purpose, if a marksman intend using the globe sight, he will have a rifle the barrel of which does not weigh more than 8 pounds, and a 90 or 100 to the pound calibre, 2 feet 7 inches long when the muzzle is off, and the guard provided with hooks, which are a great help both at off-hand and rest. He must take up a position similar

to the sketch in the Frontispiece, his left side presented to the target, but his left shoulder a little thrown back, his left foot advanced and nearly in a line towards the target, his right foot at right angles with his front, his body thrown back but slightly, and a little sideway, away from the target, so that the centre of gravity is nearer the right foot than the left, but not so much as some are in the habit of practising and recommending. The left hand grasps the barrel at about ten inches from the breech, and serves as a prop or support for the weapon, the left elbow being nearly under the barrel, but not quite; the right top-arm is thrown out square to the line of the weapon, and consequently square and level from the body, the butt-plate resting on the top part of the top-arm muscle, the right hand grasping the grip of the stock and the guard hook, and in this position, "*motionless as a statue*," when all is ready, the right forefinger gives the tap to the trigger, and then—it is too late,—it cannot be recalled. Lay it down as a maxim in off-hand shooting, that whatever part of the target the bead sight covers at the time

you give the tap to the trigger, there the bullet will be found to have struck, unless the operator has a kind of St. Vitus's dance, ycleped the "buck fever," or an easily excited temperament. If any such readers have waded so far into this volume, I would advise them to lay it down and "waddle" no further. There is no perfect cure for them without a preparatory operation, and that is to take it "*cool*" and keep "*cool*" by thinking either of their debts or sins. This prescription will not reach all cases, for I cannot, like a patent quack, cure all patients with one pill, but it will most likely apply to the majority, for all who "*finger a trigger*" are eminently troubled with both, if the decalogue be a standard measure of the one, or the frequent dunning of tradesmen and an empty purse any indication of the other.

CHAPTER III.

THE working or manipulation required in a rifle at off-hand is the same as at rest, and

consequently, I can add but little to the simple directions for position. I have found that after a day's practice, the best plan is to put a tablespoonful of bear's or lamp oil into the barrel of the rifle, having previously stopped up the vent and cone, and let it remain there till you use the rifle again. The oil saturates and loosens the residuum in the breech and communications, so that the greater part of it can be forced out with a wiping rag and a small quantity of powder, placed in the cone seat, and fired off. By this method the weapon is kept tolerably clean for several days' practice, and there is no possibility of the interior of the barrel becoming rusty, as is too often the case when water is used for cleaning out by incompetent and careless persons. However, when a rifle becomes so foul as to require cleaning out with water, use it "*boiling hot*," and be as quick about the operation as possible, and don't forget to work a quantity of oil through the barrel with a dry clean rag. After using a rifle, however slightly, always remember to clean and rub the "*outside*" of the barrel and trimmings perfectly dry, and then

apply a moderate coat of good bear's or lamp oil, either of which is better than Florence olive oil. Some people are very particular about what kind of oil they use in their favorite rifles, but good clean bear's oil or best fish oil is good enough and more "comeatable" than squirrel, coon, or deer's leg oil.

The performance which a marksman may calculate upon doing, will depend upon the state of the wind and weather. In a favorable time at rest, he ought to make at 20 rods a ten shot string of from 8 to 10 inches; at 40 rods, from 20 to 26 inches; at 60 rods, from 40 to 50 inches; at 80 rods, from 80 to 100 inches; at 100 rods, from 110 to 120 inches. At off-hand, he ought to make at 10 rods, a ten inch string; at 20 rods, from 15 to 20 inches; at 40 rods, from 40 to 50 inches; at 60 rods, from 60 to 80 inches; at 80 rods, from 100 to 120 inches, and at 100 rods, from 140 to 160 inches. If he occasionally make better work than this, it is no rule that he can do so at *any* future time, and if marksmen would not let a chance performance mislead them, they would very often save both money

and credit. With a 12 inch Wesson pistol at rest, a marksman ought to do as good work as with a rifle off-hand at any distance under 100 rods. This will appear strange to the "*uninitiated*," but it is true. In the fall of 1844, when on a hunting tour at Eaton Rapids, in Michigan, I shot at and hit three flour barrels in succession at 80 rods with this 12 inch pistol, giving 50 cents per shot. Gen. Dunham indulges in the practice of shooting across the Hudson river, at West Troy, and generally succeeds in hitting a flour barrel every time, a distance of 600 yards; a nut for those to crack who are entrenched in long barrels and large calibres, for the picket bullet of my pistol weighs only 75 to the pound.

In general, schemers are of a very sanguine and ardent temperament, and some people who can't be talked, but must be driven out of their old practices and ideas, may imagine that I am one of them, when I assert that a proper telescopic sight for target practice is as superior to the globe and bead sight, as that is to the old open crotch and silver sight. I am willing to admit that the generality of marks-

men are not qualified to use a telescope to the best advantage, and most probably this will preclude their general introduction as a sight for target practice. But I can assure those who do feel competent to use a telescopic sight, that when properly made and fixed upon their rifles, with a careful application to practice, they will never regret the outlay of 20 dollars on this instrument and fixtures. No more dovetails and defacings of the weapon are necessary than what are required for the globe and bead sight, the front movement of the telescope being effected in the bead sight dovetail, and the back movement in the globe sight. This is a great recommendation so far as appearance and simplicity are concerned, for the telescope can be taken off, and the globe and bead sight substituted in half a minute, and no one be aware that such an instrument was ever used upon the weapon. Besides, who would wish to be straining and stretching his eyes on a dull day, to ensure the centricity of the bead sight, when, with a telescope, he can centre a dime at 40, and see a bullet hole at 80 rods? For turkey shooting this sight is "per-

fection perfected," and I have reason to think it will, in conjunction with the other improvements in the rifle, drive this relic of borderism out of the pale of the more civilized interior, and string matches will be substituted, for they show in an eminent manner the perfection arrived at in the manufacture and manipulation of this "*beautiful weapon.*" At a trial of skill made at Syracuse, in the fall of 1843, General Dunham, Owens, Barney, Cushney, Sketchel, Weaver, Haight, and myself, contending for a purse of 100 dollars, subscribed for among ourselves at two dollars per string, to be won by the shortest three shot string at 40 rods, was, after some good shooting, won by Cushney with Owens' rifle, one of Edwin Wesson's manufacture, the string measuring $5\frac{5}{8}$ inches. In another trial of skill which took place at Sherburne, Chenango Co., in the spring of 1844, a fat ox, valued at 100 dollars, was shot for at 40 rods by three shot strings, and won by Barney, beating Gen. Dunham, Owens, James, Carpenter, and myself, the string measuring $4\frac{11}{16}$ inches, and made with the same weapon that won the for-

mer match at Syracuse. At a shooting-match held at Sherburne, Chenango county, January, 1845, a purse of 25 dollars, contended for by Messrs. James, Haight, Covell, Lush, and Rider, was, after a fierce contest betwixt James and Haight, won by the former making a three shot string of 3⅝ inches —Haight's shortest string being 3⅞ inches, and James's second best 4⅛ inches. The weapon used by James was made by him, with Clark's patent muzzle, and is now in my possession. In the spring of 1846, I won a fat ox at West Troy, making a five shot string at 36 rods which measured 5¾ inches, using a patent-muzzled rifle, made by James of Utica, with telescopic sights.

In the manufacture of telescopic sights, such as I have previously described, I beg to recommend M. James, rifle manufacturer, Utica. He is a first-rate "*working mechanic*," and having been employed by me in all work connected with the telescopic sight, can give better satisfaction,—"*having been through the mill*"—than those who have not. In the manufacture of rifles, Edwin Wesson,

of Northboro', Massachusetts, stands first in public estimation, as no other maker can legally use "*Clark's patent loading-muzzle*;" and a weapon so made, for target-practice, stands unrivalled in the world. How long it will remain so, depends upon the progressive mechanical knowledge to be developed in the present and future generations.

It would at the same time be unfair not to state the merits of such makers as Fish, of New-York; James, of Utica; Billinghurst, of Rochester, and many others. If fair prices be given, they may be relied upon to turn out weapons in accordance with the improvements of the age; and although not so serviceable for so long a time as the patent-muzzled, are, when new, nearly equal in precision of performance.*

* Since the above was written in 1844, Mr. Wesson has consented to allow all rifle makers to use the patent muzzle, by paying him the sum of three dollars for each muzzle, two of which he has to pay to Mr. Clark for the patent right. I hope that rifle manufacturers will duly appreciate this act of liberality, and use him in the way that such conduct merits.—*Author.*

PART THIRD.

ON THE CAUSES AND LIABILITY TO ERROR IN MAKING ACCURATE PERFORMANCES.

CHAPTER I.

It will be more profitable and natural to treat of the sources of error as they occur in going through the processes of wiping, charging, and firing, than presenting them in rotation according to their respective merits. Wiping out irregularly is a source of error, to remedy which, a number of rags of an uniform size must be cut or punched out of a piece of cotton flannel, having them washed and dried after use. I have about one hundred such rags, and use them thus: I take one and spit pretty freely upon it (preferring spittle to water), place the wet side so as to come in contact with the bore, and work it up and down with the wiper so as to loosen the residuum of the burnt powder, then use the other side of the rag in the same manner; and lastly, take a dry rag and wipe out with it, using both sides. The great object in wiping out, is to prevent

an accumulation of burnt powder along the bore; in removing which, you must guard against using too much wet or spittle, or the breech and bore will be left damp, and thus injure the ignition of the charge.

One of the most important points to be determined and secured, is an equal and similar weight of powder for each separate charge. Assuming that the strength of the powder is equably diffused throughout its mass, this can be done accurately by weighing, in a pair of apothecary's scales, each charge separately, and using a number of paper or brass tubes with stopples, containing one charge each. This process is too tedious and particular unless the marksman aim to become a finished performer, and then it is not of much advantage unless he be as nicely particular throughout the whole of the remaining operations and manipulations. A brass tube, with a wooden stopple, very nearly of the same diameter as the rifle bore, is generally used as a common charger; and from a great number of experiments which I have tried, to ascertain the liability and amount of error in using it as a

measure of weight, I am inclined to think, that with proper care it *can* be used with sufficient accuracy, and fifty successive charges measured, which shall not vary more in each charge than one drachm, *in extremes*, amounting to an error of one-sixtieth part of the whole in a charge of sixty grains. However, after all the care and attention we can bestow, this is the *minimum* amount of error; and I know that if the marksman be negligent, a difference of three grains can easily be made, amounting to an error of one-twentieth of the same charge, an amount sufficient to make a difference of four inches up and down in the flight of the bullet at forty rods. Now the causes of such errors I take to be, first, "*neglecting to have the charger filled level with its top, sometimes scant, sometimes heaped.*" To remedy this, you must see that every charge is "*striked measure*;" and to do this, fill the charger a very little heaped, hold it dually to an angle of 60°, at th turning it round with the finger grains of powder will fall down and leave it level full, or "strik

Second, "*sometimes a small lump of dried powder gets into the flask, sufficiently large to block up part of the orifice of the valve*, and in that case the powder flows out much slower into the charger." To guard against this, the powder must be carefully dried, and all the particles of dirt, cork, and lumps of powder picked out and thrown away. A piece of cork as large as a pea, in a charge of powder, will be the means of a bullet striking the target 6 inches below the average height at forty rods; for besides the quantity of powder it displaces, it hinders the instantaneous and regular combustion of the grains of powder in the breech of the rifle. Third, "the orifices of some flasks are too large for filling chargers $\frac{8}{8}$ths of an inch in diameter with any degree of accuracy." I always use a flask with a small orifice, so that the powder cannot flow into the charger very fast; for powder is liable to flow out more irregularly from a flask with a large orifice than with a small one. Any one may convince himself of this by taking a common flask, and filling the rifle charger quickly, by opening the valve as wide as pos-

sible, and placing this quantity of powder in one of the cups of a pair of fine balances: then refill the charger from the same flask with the valve nearly closed so as to let the powder flow forth as slowly as possible, and put this quantity into the other cup, and it will outweigh the first charge as much as three in a charge of sixty grains, if the grain of the powder be moderately large. Therefore it is obvious that the best way to get rid of this liability to error, is to have the valve-opening of the flask moderately small. Fourth, "neglecting to refill the flask when nearly empty." Most marksmen have, no doubt, observed in shooting away a flask of powder, that the best and most even performance was made from the first three-quarters of the quantity of powder; and that the other part of the powder in the bottom of the flask projected the bullets very irregularly. This is occasioned by the small grains of powder, together with the dust a dirt, settling down to the bottom of the fla and knowing this, you must refill the fl when about three-quarters empty, and some future time when you do not wan

do very particular shooting, blaze away until the flask be empty.

The next point to be insured is evenness in texture of the linen used in patching, similarity in the size of the patches, and their concentricity with the butt of the bullet when started at the muzzle. This can be accomplished by procuring linen of the best quality, doubling it up so that not more than eight patches are cut at one time, carefully picking them over and examining each patch separately, and throwing away such as are deficient in shape or uneven in texture. There is no way, that I am aware of, to insure the concentricity of the patch with the bullet, further than spreading it out flat and setting it, by the eye, concentric with the outside of the muzzle; then press the ball of the fore-finger upon the patch over the bore of the barrel, observing whether the print of the bore be concentric with the outside of the patch; if so, place in the bullet with the finger and thumb and seat it firm and true, apply the starter, and with "*care*," that everlasting "*bore*" to a marksman, the patch will be as true with the bullet as is necessary for the best performances.

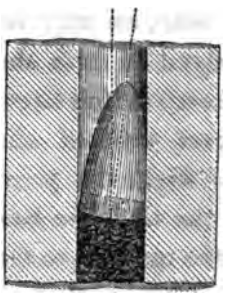
The next important point, and one imperative for fine shooting, is "similarity in weight, size, and figure of the bullets." Great advances in this respect have been made within the last four years; more so, probably, in proportion, than in the other requirements for the use of the rifle. The leads are carefully cast in a brass mould, then swedged to insure similarity in size and figure, and lastly, balanced in a pair of small scales, to insure similarity in weight. I usually, when balancing, make three distinctions amongst the leads; those of which the greatest quantity are of an equal weight, I reserve for best performances; those which are indiscriminately lighter I put in a heap by themselves, and those which are indiscriminately heavier I put in another heap by themselves, using both for trial shots and common practice.

CHAPTER II.

ANOTHER cause of inferior shooting is "starting the bullets irregularly and not twice

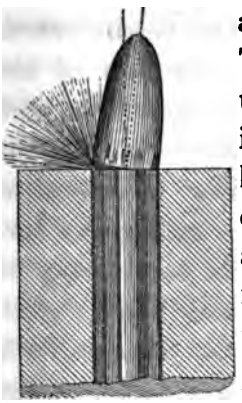
alike." This will always be done when using the common straight starter, and the degree of irregularity will depend upon the mechanical gifts of the operator. Rifle makers generally, and some few others, can manage to do good shooting and use a straight starter; but it is not a fit instrument in every marksman's hand; and for that reason, the "guide starters" ought to be used with the best target rifles, and furnished with the weapon in the first instance by the rifle manufacturers. It is the opinion of some marksmen that it is not of much consequence whether the bullet be started perfectly straight or slightly crooked. Now I know, from a great number of experiments, that if bullets be started straight with the bore, every thing else being right, they will fly straight and true; but if they be started crooked, they will fly irregularly, whether every thing else be right or not. This irregularity of flight is partly caused from the patch being tight on one side at the edge of the butt of the bullet, and on the opposite side scarcely touching it; the top of the patch sinking in deep at this side, and scarcely touching at

that, as will be seen by inspecting the annexed



sketch, (to full size,) which shows the bullet at the breech end put down crooked, or so that the axis of the bullet is not coincident with the axis of the bore of the barrel. Now it is evident that the point of the bullet in making one revolution around the axis of the bore during its flight, (which it will do generally in a "gaining twist" about once in 3 feet 6 inches,) will describe a spiral line around a cylinder; the radius of which cylinder is the distance the point of the bullet is from the axis of the bore of the barrel. Now this amount in itself is too insignificant for notice, and were it not for the production of other sources of error, a bullet put down crooked would fly very nearly as true, but not quite so high as if put down straight; and the most decided or is the ejectment of one side of the butt of bullet before the other in passing out a muzzle during its flight, allowing the ling gas generated by the charge t

one side before the other, giving the bullet a direction towards the open side, as may be observed in practice and judged of from the annexed sketch (to full size). To whatever side of the true line of flight the point inclines at the time the bullet passes the muzzle, to the opposite will it be projected, and the whole of the shooting be bodily lower, from the increased friction of the patch and bullet on the lands and creases, and the irregularity produced on the front of the bullet by the edges of the starter, destroying, in fact, all the advantages of the patent muzzle.



Another source of error, and a serious one, is "the placing the bullets down upon the charge of powder with the wiper, lightly at one time, and jamming them down hard at another." After a great many experiments with nine or ten rifles of different internal constructions, so far as freeing and cutting is concerned, to determine the amount of differ-

ence in the flight of bullets placed down lightly and jammed down hard, I have come to the conclusion, that at the distance of 40 rods, with a charge of powder of 2 inches of the bore, a difference of 4 inches up and down can be produced. In some rifles, when the bullet is jammed down hard, the difference from the general level of the shooting is over ; in others, under. This I account for by their internal construction. Wesson's are freed in the creases more than those of any other maker that I am acquainted with, and the leads from his rifles, when jammed down hard, strike below the centre ; when from James' and others, who do not free the creases any more than the lands, they strike higher. I consider that the size of the vent-hole and cone have a good deal to do with it, for the escape of propellant gas from them must be greater when the charge is pressed down hard by the bullet, than when pushed down lightly. I advise all marksmen to put the bullets down lightly, but hard enough to insure their presence upon the powder, and as nearly alike every time as possible ; which may be done to a nicety in a properly free

weapon, avoiding the "ram jam" system altogether, for it has a tendency to crush up the grains of the powder, and also deprive the charge of its due quantity of atmosphere, which, probably, has more to do with the proper effect of gun-powder than we are actually aware of. I think it proper here to state that the size of the grains of the powder must be proportioned to the size of the calibre combined with its length. In general, short barrels require quick, consequently small grained powder; long ones, slow, consequently large grained powder. I consider that a bore 2 feet 8 inches long and from 90 to 100 to the pound calibre is a standard for a flat-ended picket bullet, with two inches of the bore or about five calibres of powder of such quality as is manufactured for the express use of these rifles. If quicker powder were used, the bore must be reduced in length to about 2 feet 4 inches, and in size to from 110 to 120 to the pound, the only means left, in my opinion, by which the efficiency of these rifles can be improved; and then there are doubts whether the "lightning of such quick powder" would

produce a regular and steady performance. I am aware that such a combination would drive the bullets quicker, and consequently lessen the time that the disturbing causes of the atmosphere have power to act upon them; but there is danger of irregularity when the bullet is started at so great a velocity as to "*upset*" it. In case any one should question the power of powder to upset a leaden bullet, I may as well say that such upsetting can be produced at any time in a Wesson rifle by using 2¼ inches of the calibre of Dupont's or English rag powder; and to guard against this upsetting, some marksmen imprudently use hard lead.

CHAPTER III.

One of the principal causes of irregular shooting is the upsetting of the bullets, arising either from overcharge or overstrength of powder. The simple fact that leaden bullets can be, and are upset, is startling enough; and shows conclusively that "*common powder*"

does not burn instantaneously at the breech, but expands considerably, before the gas or force becomes disengaged from the residuum or dirt. And it further proves, that the purer the component parts of the powder, the greater the heat, and the more instantaneous the development of the propellant gas. For two inches of the bore of common powder of suitable grain will not upset the bullets in a rifle of 90 to the pound calibre, whereas the same charge of Dupont's or English rag of the same grain, will, from the same weapon, knock the bullets into a cocked hat; and this upsetting is more liable to take place in long bullets than short ones, inasmuch as the long bullet is heavier and having more *vis inertiæ*, opposes more resistance to the blow communicated almost instantaneously by the propellant power of such quick pure powder. These facts have led me to the conclusion, that we can only use powder of limited purity or strength in these rifles, and do first-rate shooting; for to my certain knowledge, the moment a rifle commences upsetting the bullets, so soon does it commence shooting inaccu-

rately and unsatisfactorily. I have expressed this opinion to Mr. Wesson, who in 1846 supplied James and me with powder very nearly, if not quite, as strong as Dupont's and English rag, and with which we could not do first-rate shooting. Furthermore, these facts force upon me the conviction that powder, proportioned for great strength, and the ingredients of which are as pure as art and science can make them, tends, when ignited either in a rifle or any other tube, and whether the bullet be lead or cast iron, to fracture as well as propel. And from what does this tendency to fracture arise from? undoubtedly from the expansive gas being generated very suddenly at a very great heat, being compelled as it were to spend a great part of its force upon the *vis inertiæ* of the bullet and the resistance of the atmosphere. I have spent a great deal of time and thought on this subject, and conclude that if we could produce an inferior power to overcome the *vis inertiæ* of the shot, be it lead or iron, in a rifle or cannon, and then apply the strongest "*propellant*" force which powder is capable of pro-

ducing, we should by these means overcome the *fracturing tendency*, and thus obtain a much higher velocity and range than has ever yet been effected.

It is advisable not to overwork a rifle; that is, not to fire in too quick succession, for such overworking heats up the barrel too much, and is apt to make the marksman too eager and careless in galloping through the manipulations. "Take it cool," says the old saw, and your weapon will perform better; and if a few bad shots should slip out, you will have better means of judging whether the rifle or yourself be at fault. It is best to fire each shot in nearly equal intervals of time; a rifle thus worked, will, after six or eight shots, be at an uniform temperature at each discharge.

A marksman is liable to "*cant*" his weapon over sideways more at one time than another. This is a fruitful source of bad shooting to new beginners, and the "*uninitiated.*" The best way to guard against it, is to see, when at rest and without looking through the globe sight, that the stalk of the bead sight be up-

right, and this is as necessary as cocking the lock. It is evident to whichsoever side the front sight inclines, to that side of the centre will the bullet strike; and the greater the distance of the target, the greater will be the error. The knowledge of this induces the author and some marksmen to hold into wind or down wind, as the case may require, by keeping the bead on the centre, but the stalk inclined sideways, and this will succeed with a trusty weapon, in the hands of a skillful operator; but I should advise all young practitioners to hold "*dead on the centre*," with the sight as upright as they can get it. It is good practice to sit down at rest and take aim, and fire off caps on an empty weapon with telescopic sights, observing how the stroke of the lock moves the weapon sideways, and also, how much and how quick you are liable to "*flinch*,"—for I verily believe we all flinch more or less; but the great point to arrive at, and which can only be done by constant training or the possession of a very healthy nervous system, is, not to flinch "*before*" you touch the trigger, but "*after*," when the recoil has taken place.

I have now treated of all the errors that a marksman is liable to make in using a rifle for the purpose of target practice in particular, and inferentially of any shooting where the aim is accuracy, and the weapon made with Clark's patent loading-muzzle, or without, as made by most makers in the State of New-York. Some of these manufacturers cut their rifles with square-sided creases, others with square-sided lands, or what is called dovetailing, others use the French or ratchet-cut; but the best performing weapons of these makers are all based upon the combination of principles first brought into successful practice by Edwin Wesson, of Northboro', Massachusetts, who has the exclusive right of using Clark's patent loading-muzzle. The policy on the part of Mr. C., in allowing one maker to engross this exclusive right, I shall just notice. I presume that he did not appreciate the general use of expensive sporting rifles, and the policy of all marksmen that no one shall have a weapon superior to their own. Mr. C. may have been induced in the first instance to insure the complete success of his

invention, to put the right of using it into the hands of an accomplished maker; and I am inclined to think, from some of the specimens of muzzled rifles which I have seen in several of the States, that such a proceeding was based upon solid ground; but total exclusion of all other makers at the present time is not politic, so far as all parties are concerned, and is somewhat anti-republican in its spirit. Rifles with false or loading muzzles are made by many of the makers in the States of New-York, Ohio, and Michigan; but, with one or two exceptions, they are inferior in point of finish and performance to those made by Wesson. I do not mean to say, that other makers of acknowledged merit *cannot* make a rifle equal in performance and finish to one made by Wesson. I have evidence that some of them *can;* but the base upon which they build is the general principles and combinations of the Wesson rifle, with some lame variations and rickety ideas of their own. In fact, they are compelled to use the patent muzzle in order to obtain a livelihood, and to keep up their standing as makers. Rifles are made without

patent muzzles, but their internal construction is similar in all respects to a Wesson rifle, viz., a "*gaining twist*" and a "*freed bore*," using a flat-ended picket with heavy charges of powder; at least those are, which to my knowledge perform the best; and a rifle thus made in the hands of a skillful and careful operator, is equal, in the first stage of its use, to a patent muzzled one; but with whatever care it be treated, its performance will, after 2 or 300 shots, be inferior, and the diameter of the circle of error on the target be very sensibly increased. This can be partially remedied by the maker in refreeing it, but it is not very convenient and pleasant to pack up and send off a rifle 2 or 300 miles every month for such a purpose. Indeed, a marksman is compelled, under all circumstances, to use the best weapon he can obtain; and the best weapon of the present day, is the patent-muzzled one. It being necessary that marksmen should know which is the best kind of weapon for their use, if accurate target-shooting at rest or off-hand be required, I am thus compelled to touch upon a rather delicate

subject, and I hope in such terms as will not offend the truth, nor the parties interested. I am not inclined to flatter, either from nature or friendship; and if my opinion be requisite, it shall be given in such terms as I may see fit to employ, not sacrificing truth to the one, nor conscience to the other.*

* Since the above was written, Mr. Wesson has generously permitted all rifle makers to use the patent loading muzzle, by a payment of three dollars for each. I prefer, however, to let the text remain as originally written in 1844.

PART FOURTH.

ON THE THEORETIC PRINCIPLES UPON WHICH ACCURATE PERFORMANCES OF THE RIFLE ARE FOUNDED.

CHAPTER II.

The principles upon which a rifle ought to be constructed were more fully understood by Robins than any other writer who has treated on the subject. This philosopher and mathematician was employed, about a century ago, by the British Government, to conduct a course of experiments for the express purpose of determining a number of the then unknown causes and effects produced in gunnery and projectiles, and ably did he perform the duty. Although we have since become more perfected in manufactures, and in knowledge of the arts and sciences, little has been added to his theories, and less perfected from his deductions. Indeed, the British Government appear to have acted in direct opposition to some of the most obvious, simple, and most easily understood maxims and deductions of that eminent man. What could have induced

them to introduce that bungling abortion, the belted bullet, into the rifle service? Perhaps Dr. Ure explains it when he says, "that some companies of the rifles did better shooting with this bullet at 300, than with the old ones at 150 yards!" If, instead of making comparisons with weapons of the most approved construction of the present age, you go back 100 years and institute comparisons with what even then was a very inferior weapon, the difference in performance must evidently be glaring indeed. The Doctor certainly does not know, practically, any thing about the matter; and if he ever read Robins or Hutton, he has either forgot all their deductions, or kept them out of sight for a season; otherwise he would unquestionably have left some mark of his mind in the article, "Military Rifles," in his otherwise generally useful dictionary. If the Doctor had really examined or made a comparison in person, or by competent proxy, or, in fact, obtained his information from any where but where he did, he would not have lluted his pages with fulsome compliments, ely to mislead, and unmechanical combina-

tions, exploded centuries ago. The Doctor sums up with the comfortable assurance that the "British line will be more murderous than ever!" We generally, and always ought to gather "wisdom from defeat," but the present government seems "self-satisfied" with victories obtained over the gentle Indian and the stupid Chinaman, forgetting those tremendous lessons taught by a different race of men at the battles of Bunker Hill and New Orleans, where the rifle asserted its terrific superiority, when used, as it always ought to be, under cover of some description or other. It is idle to say that either the British or Americans are cowards; they are of one stock and blood, stubborn and courageous to the death. The British have excelled in the open field, the Americans in the woods or under cover, simply because they were educated so. An army of 50,000 men, landed upon the Atlantic coast, intending to remain or penetrate into the interior, would inevitably be destroyed or captured in three months, and this would be effected principally with the rifle. A man accustomed to carry a rifle with as much care as an Old

Countryman does a watch; educated, perhaps born in the woods, accustomed to hang his life upon the "certainty of a sure shot," is a tremendous overmatch for another, who knows his weapon only on drill; never saw a clump of trees larger than those in Hyde Park, and who, as a marksman, is likely to hit neither the tree nor the man behind it. But to return.

The principle upon which a rifle is intended to be constructed, and in which only it differs from a musket, is, "*the giving the bullet a rotary or spinning motion round its axis, and keeping that axis, as near as can be, coincident with its line of flight or progressive motion; thus enabling the bullet to overcome any undue deflection, by presenting its irregularities of weight and form in circular succession to the friction of the atmosphere, during the whole course of its flight.*" *

* Robins, in speaking of the deflection of a bullet from a smooth bore, says: "If it he asked what can be the cause of a motion so different from what has been hitherto supposed, it may be answered, that the deflection in question must be owing to some power acting obliquely to the progressive motion of the body, which power can be no other than the resistance of the

To accomplish this, spiral grooves or creases are cut by a machine along the internal surface of the bore of the barrel from breech to muzzle. The bullet being somewhat larger than the bore, fills up, when loaded, these creases with lead and patch, serving as guides for the accomplishment of this rotary motion in the same way as the threads on a bolt serve to give a rotary motion to a nut. A bullet when projected from a rifle becomes possessed of two motions: a progressive or forward motion, generated by the propellant power of the powder; and a rotary or spinning motion, communicated by the spiral creases inside the barrel; and its mass or weight is constantly acted upon by the force of gravitation, and its size or surface by the resistance of the

air. And this resistance may, perhaps, act obliquely to the progressive motion of the body, from inequalities in the resisted surface; but its general cause is doubtless a whirling motion acquired by the bullet about its axis; for by this motion of rotation, combined with the progressive motion, each part of the bullet's surface will strike the air in a direction very different from what it would do if there was no such whirling: and the obliquity of the action of the air arising from this cause will be greater, according as the rotary motion of the bullet is greater in proportion to its progressive motion.—*Prin. of Gunnery, &c.*

atmosphere in the ratio of the square of the velocity; and both these causes of retardation, in conjunction with the weight and velocity of the bullet, tend to produce the line or curve of flight, which, however, has been shown by Robins not to be a true parabola. In any number of shots, the rifle being loaded and held always alike, the lines of flight would always be coincident, were it not for the irregular action of the wind and the varying weight of the atmosphere; and to combat successfully these impediments, requires the finished marksman. Theoretically, in using a rifle or cannon, there are to be considered and admitted the line of sight formed by the sights on the piece, the line of flight of the bullet formed by its path through the air, and the line of the axis of the bore of the barrel. The line of the axis of the bore is considered a tangent to the line of flight of the bullet at the muzzle of the piece; consequently, the bullet commences falling from this line of the axis of the bore as soon as it leaves the muzzle; therefore, if it be wished for the bullet to hit a given object, the line of sight must be made to cut or

intersect the line of flight at the distance from the muzzle that such object be placed; and it is evident that the line of sight CAN be made to intersect the line of flight at any point between the muzzle and the extreme range. It is a source of great trouble to many, who do not understand the technicalities of war, when they read of the "guns opening with grape at *point blank* range." Point blank range in theory and practice means nothing more than the object fired at being at the point of intersection between the line of sights and the line of flight; and a cannon, the metal being thicker at the breech than the muzzle, gives the line of the axis of the bore a considerable elevation above the line of sight, formed as it is upon and along the outside of the piece, sufficient to make the point blank range of a common 12-pounder, using solid shot, be at or near 200 yards.

CHAPTER II.

HAVING laid down the general principle, it is now essential to treat of those particulars which in combination tend to produce the most effective weapons. In so doing I may disagree in opinion, and theory, and experiment, from a great many others who are troubled with "set or fixed notions," based upon ignorance and non-inquiry; but I do not expect to differ much from those who have seriously, anxiously, and comparatively, "worked out" their information.

Prin. First. "*It is obvious that the proper degree of twist is the great point to be obtained; for it is evident that too little will not spin the bullet sufficiently quick to equilibrate its form and irregularities, and it will soon cease to fly true; whereas too much will produce too much friction in the barrel, and in the course of the flight of the bullet also, by presenting its surface in too quick succession to the action of the atmosphere; consequently, whatever degree of twist is given to the bullet more than is really requisite for its true flight, necessarily retards*

its progressive motion, and is so much power or powder actually thrown away." It has been proven by a great number of experiments, to my satisfaction, that at the distance of 220 yards a calibre of 90 to the pound, and the barrel 85 calibres long, using a flat-ended picket weighing 140 grains troy, with about 6 calibres or 60 grains of powder, of *moderate strength*, with a gaining or increasing twist ending at one turn in 3 feet 6 inches, will project its bullet with less variation in a side-wind, than any other combination of calibre and twist. To produce the greatest effect at 440 yards, it is necessary to have the calibre 80 to the pound, and the twist end at one turn in 3 feet 3 inches; and at 660 yards, a calibre of 70 to the pound, and a twist ending at one turn in 3 feet. For long ranges and large calibres, the powder ought to be weaker in general strength, and the grain much larger than is now used in our best 40 rod rifles.

Prin. Second. "*In a rifled barrel, it is obvious that a bullet instantaneously started from a state of rest, with a velocity of* 5000 *feet* per*

* Robins and Hutton differ as to the expansive velocity of

second, must exert at the moment of starting a tendency to move out along the bore in a direct or straight line. However, meeting with the resistance that the lands employ to keep it to the twist, it communicates to the rifle itself a certain amount of twist or motion in the direction of the twist of the creases; and this certain amount increases as the degree or angle of the

inflamed gunpowder. Hutton says: "We have shown that inflamed gunpowder is about double the strength that he (Robins) has assigned to it, and that it expands itself with the velocity of 5000 feet per second." This is not strictly in accordance with truth; for Robins "ascertained the volume of air formed by a given quantity of powder, and then supposed that this elastic fluid was exposed to a heat equal to redness, by the explosion of gunpowder. He also found by experiment, how much the volume of a given bulk of air was increased by a red heat. The first production of air gave him a force of about 244 atmospheres, or that the original volume of powder was multiplied by that number. The red heat he found would multiply this volume by about 4·1. This gave about 1000 times for the increase of volume. The force of its action would therefore equal so many atmospheres, or 1000 × 15 lbs. upon a square inch. When this force begins to move, it decreases with the dilatation, and exactly in the same ratio. *Mr. Robins not only ascertained the velocity given to the bullet by a given weight of powder, but he fired the powder alone, which having no weight to move, would expand itself with the greatest velocity.* He found that under these circumstances, the velocity of expansion was 7000 feet in one second of time.

twist increases, combined with the size of the calibre, and the weight of the bullet or body thus instantaneously put in motion. And therefore, if the angle of the twist at the breech end can be reduced, the bullet at the same time leaving the muzzle with twist sufficient to comply with the terms of the first principle, it is certain we shall have less twisting of the rifle in the marksman's hands, less friction of the bullet against the lands, less tendency for the bullet to upset, and consequently from obtaining higher velocity, because enabled to use a greater charge of powder, less time for the action of regular or irregular currents of air."

The "*increasing*" or "*gaining*" twist was introduced into the combination of the improved American rifle by Edwin Wesson. I am not aware that any one in particular claims its invention, or I would award him all the praise it deservedly merits. I venture to assert, in the face of those who are sticklers for a regular, nay a decreasing twist,* that a rifle

* Greener, the author of "The Gun and the Science of Gunnery," is *green* enough to advocate a decreasing twist, because the motive gas does not propel the bullet as fast at the breech as at the muzzle! What! knowing from experience that one turn

with a gaining twist, in a windy day at 220 yards, will make a string one third shorter than a rifle with a regular twist. I consider at that distance, that a rifle with a regular twist of one turn in 4 feet, with a calibre of 80 to the pound, performs better than any other; and I know that such weapons with a charge of 2 inches of the calibre of powder will, when fired, twist over sideways in spite of all you can do, and also "kick" or "recoil," very severely. Surely, if such recoil and twisting can be felt and seen, the tendency for the bullets to scatter and strike the target in a circle, and not in a

in 4 feet must be the twist at the muzzle, go and start the bullet at the breech at one turn in 2 feet? Ridiculous! Better keep it regular at one turn in 4 feet, unless friction decreases as the twist increases. Several rifle makers of good standing in the States were of the same opinion as Greener, but their number is fast diminishing. Fish, of New-York, erroneously thought that nothing is gained by the employment of the increasing twist, friction being sacrificed to accuracy; because, if the barrel were reversed, the bullet would come out with much less friction; and undoubtedly it would, but the terms of the first position would not be complied with. Let the twist at the muzzle be determinate and fixed, as it really is for accurate shooting, and it is evident that the increasing twist has less friction than a regular twist similar at the muzzle; consequently much less friction than a decreasing twist ending similar at the muzzle end also.—

straight line, is easily accounted for; for remember that this twisting motion is generated and commences at the very instant that the bullet is put in motion, and consequently the axis of the barrel at the breech end must shift its position, and point, when the bullet leaves the muzzle, in a direction different from what it did when the trigger was pulled; for it must take some length of time, (about the 1000th part of a second,) however infinitely short, for the bullet to move from the breech to the muzzle of the weapon.

The circle of error in these weapons at 220 yards is never less than six inches; whereas, in an increasing twist, it will not be more than two inches, and sometimes only one. Any one may convince himself by experiment that a rifle with a regular twist of one turn in 6 feet has but little tendency to twist sideway even with a charge of 2½ inches of the calibre of powder. Assuming then from experience that 4 feet is as much as a bullet of 80 to the pound ought to make one turn in during its flight, and that a bullet can be projected out of a twist of one turn in 6 or 7

feet without any injurious twisting of the weapon; then these degrees of rotation can be given to it at the breech and the muzzle, just as well as starting and driving it the whole length of the barrel through a regular twist of one turn in 4 feet. Is it not reasonable, that if the bullet can be started and driven along the 4 feet regular twist at all, it will be started and driven with much less friction along the increasing twist commencing at one in 6 and ending at one turn in 4 feet? Assuredly so; and practice shows that the twisting of the rifle can scarcely be perceived, and the recoil not worth noticing. I should not dwell so long upon this point did I not know that an erroneous opinion is entertained by some respectable mechanics. It is not generally known by rifle makers and others, that an increasing twist is a true geometrical line formed by the application of an arc of a large circle to the surface of a cylinder; and the radius of this circle must of necessity be longer for a slow, and shorter for a quick gain. The usual method of laying out this line on a rifling cylinder is by means of compasses and mea-

surements, which at the best is only a rude and unsafe approximation to truth, and the curve on machines so made abounds in crooks and irregularities. The radius of the large circle generally ranges from 30 to 40 feet, according to the notions of the rifle manufacturers.

Prin. Third. "*It is evident that the degree of twist at the muzzle of a rifle must be proportioned to the size and weight of the bullet, combined with the speed or velocity intended to be given to it.*" In obtaining the combinations of a perfect rifle there are certain points to be attended to, or the weapon is deficient and inferior. I can beat any man whose rifle has a combination deficient or inferior in the above points. It is desirable to give a bullet as much velocity as it can safely be started with at the breech, and the limit to this velocity is the liability of the bullets to upset, and as soon as this upsetting takes place the performance becomes inferior and the circle of error enlarged. As a general thing, 2½ inches of powder in an 80 to the pound calibre, will upset bullets made from good soft McCulloch bar lead. It

is also clear that a bullet projected with sufficient twist to keep it steady in boisterous and windy weather, must of necessity have more twist than is actually necessary in a still, favorable time. Therefore a rifle for general shooting should always have too much, rather than too little twist. It is possible to use 2½ inches of the calibre of powder of good quality with bullets made from hardened lead; but with them the performances of the very best rifles are not to be trusted to, either from the difficulty of hardening lead evenly throughout the mass, or from the hardening mixture of tin or antimony destroying the property of non-elasticity possessed by pure lead, and consequently the patch is shaken into slivers. I do not recommend the use of hard lead, although in very bad weather tolerably good performance may be produced, from the fact that the diminution of error sideway from the action of the wind compensates for the increased circle of error, or the increased action of the bullet round the centre. Young marksmen should stick to soft leads and hard beds, and leave "*soft sawder*" in the tin-shop.

CHAPTER III.

Prin. Fourth.—"*It is evident that the size and weight of the bullet must be proportioned to the distance it is intended to be projected with the greatest precision; for it is a law in mechanics, that 'in bodies of equal densities small ones lose their momentum sooner than large ones.'*"

This is a point which requires particular attention. It would be madness for a marksman to use a 90 calibre at 160 rods, merely because it performed first-rate at 40; or a 40 calibre at 40 rods, because it performed well at 160. I have given the result of my experience as to the proportion of calibre to distance in treating of the first principle. It may naturally be asked why a 90 calibre performs better at 220 yards than a 40. The reason is, that the 40 cannot be projected with as much velocity at 220 yards as the 90 can; and why? because the 90 uses more powder in proportion to the weight of the bullet than the 40 does, although the section of the bullet of the 40 increases in a less ratio than its weight,

which is so much in its favor.* The circle of error at 220 yards in a perfectly still time may be equal in both; but in the least wind, it would require the judgment of an angel to keep the bullets of the 40 together sideways. Again, why does the 40 perform better than the 90 at 880 yards, when you have admitted that the 90 has the greatest velocity at 40 rods? Simply because the force or momentum of the 90 is nearly expended at the range of 880 yards, consequently its rotary motion is not sufficient to keep it in the true line of flight; whereas the 40 having nearly as much twist as the 90, and its weight insuring more momentum, keeps nearer to the true line of flight; having in fact preserved for a longer distance those essentials for a true flight which it started with when it left the muzzle of the weapon. From this it will be perceived that

* The contents of spheres increase as the cubes of their diameters; whereas circles, and cylinders of an uniform length, increase as the squares of their diameters. In other words, a round bullet half an inch in diameter, has eight times as much matter in it, consequently, eight times as heavy as a bullet one quarter of an inch in diameter, while it has only four times as much sectional surface.—*Author.*

the twist of rifles for long, ought to be much quicker than for short ranges; for it is not only necessary to have weight to insure momentum, but twist enough to enable that weight to keep a true line of flight at a velocity very much inferior to what it was at the first 40 rods of its flight. I am aware that this qnick twist reduces the velocity of the bullet, but for long ranges it is indispensable for best performances.

Prin. Fifth. "*It must be admitted that no more powder than a certain proportional length of the calibre can be effectively used or burnt in any rifle barrel; and this proportional length is of course governed by the size of grain and quality of the powder, the diameter and length of the calibre, and the resistance offered to its expansion by the vis inertia of the bullet.*" I am inclined to think that our rifle bullets get a considerable start before the whole blast of the exploded powder operates fully upon them; not confounding this, however, with the accelerated velocity afterward given to the bullet in moving along the bore by the expansive force of the propellant gas. Hutton

says, "It is probable even that the powder does not inflame all at once, and it is certain that the greatest part of it, namely $\frac{7}{10}$ths, consists of gross matter not convertible into an elastic fluid, which matter will, in the explosion, be mixed with the elastic part, and will, by its weight, retard the activity of the explosion." It is well understood that the powder used by Hutton, in his experiments, was very inferior in purity to the common sporting powders of the present day; and I am of opinion, that for the most accurate performances with the improved rifle, the powder must have only a certain amount of expansive velocity, very far below what can be produced from the best English sporting powders. Indeed, it appears to me, so soon as powder reaches a certain high amount of velocity, that its expansive force tends to fracture as well as propel, (and thus the irregular performances made with very fine quick powder, may be satisfactorily accounted for,) and that there is a certain amount of velocity of expansion, which is the limit for best performance, and which can only be obtained from

experiment.* This observation I intend to apply to smooth bores, as well as rifles, although I am aware that bullets can be projected with much higher velocities from a smooth bore than is admissible from a rifle, because the point of best performance in a smooth bore can never be ascertained; consequently high velocity and length of range have been generally sought for by those who have treated and experimented on the subject, since the time of Robins and Hutton. Hutton came to the conclusion that a velocity of 2000 feet, for the first second of time, was as much as could be practically employed in cannon, although he proved the possibility of obtaining a velocity of 3181 feet per second. I must remark here, that the velocity of a bullet at the moment it leaves the muzzle of

* This is fully corroborated by the use of gun cotton in a rifle, the fracturing power, from the purity of the composition, being so great that the barrel will either burst, or the bullet will be rent and driven against one side of the bore so hard as to fill up the creases with lead. I advise all marksmen to use gunpowder for rifle shooting; if they wish to commit suicide, let them use gun cotton, and their object will be attained most certainly.—*Author.*

the barrel, must be much higher than 3181 feet per second, to allow it to average that velocity for the first second of time; and the oversight of this has been the cause of a good deal of writing to no purpose.

Prin. Sixth. "*It is well known that the size of the grain of gunpowder, ought to be proportioned to the length as well as the diameter of the bore of the barrel.*" It would be madness to use coarse grained powder in a 12 inch pistol, with a calibre of 150 to the pound, or fine sporting powder in a rifle barrel, 3 feet long, with a 70 calibre. The expansive velocity in the one would have reached its highest point at half the length of the barrel, consequently have the velocity reduced, from the opposition of the column of air in the remaining half, which has to be condensed before the bullet can be discharged from the muzzle; the expansive velocity of the other could never attain the height of which the charge was otherwise capable, because the length of tube is insufficient to allow of such expansion, and as a necessary consequence, a considerable number of grains of powder would be expelled

without being burnt. Reverse the position, and a much nearer approximation to what is desirable will be obtained. The fine quick powder in the pistol would receive no counteraction to its effect, from unnecessary condensation of the air; and the coarse grained powder in the rifle, would have length of tube sufficient to allow the charge to get thoroughly ignited and reach its maximum velocity near the muzzle.

CHAPTER IV.

I WILL now give a condensed opinion of the few points essential for good combinations, and of the limits which appear to be set against using high velocities in the rifle, at the same time obtaining the most accurate performances. In the first place, it appears from experiment, that certain calibres perform best at certain distances, and that a bullet of the flat-ended, picketed form, is the best now in use,* as it

* This is strictly in accordance with one of Robins's deductions. He says: "it would therefore be a great improvement in

combines more momentum with less resistance to its progressive motion; for its section, weight for weight, is much less, and its pointed form pierces the atmosphere with less resistance, than the round bullet. It also appears that the length of those bullets, for the most effective performance, must be governed by the degree of twist, combined with the velocity intended to be given them; and the quicker the twist the longer may be the bullet, and the higher the velocity the longer may be the bullet also.

There also exists a proper degree of twist for each calibre, assuming the velocity at starting to be limited by the upsetting point. There also exists a proportion betwixt the size of grain and the length and diameter of the calibre; large grained, slow powder requiring a longer calibre than quick, fine grained powder, in order to obtain its maximum point of velocity. In proportioning the grain of

artillery, to *make use of shot of a long form*, or of heavier matter; for the momentum of the shot when fired with the same weight of powder would be increased in the ratio of the square root of the shot."

powder to the length of calibre, it is desirable to have the maximum point of velocity somewhere near, but within the muzzle of the barrel. It also appears that the bullets require a certain amount of friction, in moving along the bore, to ensure the most perfect delivery at the muzzle; and this amount of friction must never be reduced so as to allow the flame of the powder to pass by the bullet, an error into which Mr. Wesson fell in 1844;* and it does appear that friction, to a *certain extent*, is absolutely necessary for the retardation of the bullet as it approaches the muzzle, so that the full effect of the expansive power of the powder may be communicated to it. After all these requisites are complied with, it is certain that the charge of powder, consequently the velocity, is limited by the up-

* The organs of perception and causality must have predominated in Robins's head. In speaking of friction, he says: "From all that has been said, then, about the use of rifled-barrelled pieces, it is sufficiently obvious, that whatever tends to diminish the friction of those pieces, tends at the same time to render them more complete." The application of this splendid deduction first appeared in a Wesson rifle just one hundred years after its conception by Robins!

setting of the lead. If any one can succeed in hardening lead, without destroying its essential quality of nonelasticity, he would deserve the thanks of rifle shooters generally, he certainly should have *mine*.

After the most careful attention to all the essential points in combination, with all the assistance that can be obtained from the best mechanics of the age, so far as construction is concerned, we are compelled at last to writhe under the lash of imperfection. There is nothing perfect in the work of man. We discover at last, that we have the perception of perfection, but the thing itself is denied us. We may imitate the motion of the earth, by giving the bullet a rotary as well as a progressive motion, but we cannot make the lines of flight coincide, and we end as we began, in error.

The term "circle of error," has been used in this work somewhat freely, and it may be as well to explain what is meant by it. Assuming that the air is perfectly still, it is evident that all divergence from the true line of flight, must and will arise from imperfection in the construction of the rifle, inequality in

the strength of the powder, difference in the densities of the bullets, irregular patching, and untrue starting, irregular combustion of the powder in the bore, and imperfect delivery at the muzzle, and some little from unsteady holding, although the telescopic sight has reduced this so much that perfect holding depends upon the powers of the marksman. Now a first rate rifle with a telescopic sight, will in a still time, at 220 yards distance, throw all her shots into a circle 1½ inches in diameter, and at 440 yards, into a circle of 8 inches in diameter; that is, the rifle will do it, if the marksman perform his part. This is the circle of error. Any one may convince himself of the power of his rifle when the wind is steady, and blowing across the line of flight of the bullets, by holding dead on the centre, and after firing 20 shots, measure how much two parallel lines to the horizon, drawn through the extreme up and down shots, are apart, and this distance will be the diameter of the circle of error, in a still time, somewhat large however. In judging of the powers of a rifle, it is necessary to note also how much the bullets are

varied sideway by the inconstant action of the wind. A rifle with an imperfect combination for the distance may possibly make as small a circle of error, as one properly proportioned in all respects; but the variation sideway, or the "*parallelogram of error*," will be much larger, and consequently be an inferior weapon at that particular distance.

My labors are now drawn to a close; but I cannot forbear offering a few observations to those engaged in scheming those monster pieces of ordnance, which to me appear more as weapons of curiosity than utility. I am willing to concede that the longer the range intended to be acquired, the larger must be the calibre, consequently the heavier the shot; but at the same time the combination of length of calibre, size of grain, and strength of powder, imperatively demand attention, but which in these new pieces are evidently disregarded, and their range does not meet expectation. It may be urged that if the length of these guns were in calibre proportion, they would be unmanageable, and undoubtedly they would. But what advantage is gained

by the employment of a gun 12 inches in diameter, and 12 calibres or 12 feet long, when an 8 inch gun of the same length, of 12 feet or 18 calibres, would unquestionably give its bullet one third more range? I pause for an answer. If the game of long balls is to be played for the future in naval warfare, it is evident that these monsters are useless, because inferior in range, whether carried by steamer or man-of-war. If these large guns be carried by steamers, why cannot they be carried by men-of-war also? And if the man-of-war happen to have an 8 inch, and the steamer a 12 inch gun, the probability is rather strong that the steamer will be crippled or sunk before she gets her 12 inch gun into range; for scheme a steamer as you may, they can never stand the hammering that a man-of-war will. Put the 8 inch gun on board of the steamer, and the 12 inch on board of the man-of-war, and it is evident that the man-of-war is at the mercy of the steamer. However, it is further evident that whatever guns can be carried by a steamer, can be carried by a man-of-war also, and therefor

the only advantage the steamer has, is in being able, like a fish-hawk, to prey upon the small weak fry, and flee away when attacked by the longer ranging eagle. Therefore I cannot see that the use of the old line of battle ships can be dispensed with. There must be some limit to the weight and length of guns, and, for practical use, more limited for naval than land service; therefore the sensible way of going to work is, to determine by experiment the size of calibre to the maximum admissible length and weight of gun, so as to obtain the longest possible range. The use of lead, instead of iron, for cannon balls has been suggested, and it is somewhat surprising that so few experiments have been made with it. I am of opinion that much longer ranges can be obtained from a leaden ball projected from a six inch calibre, than has ever yet hitherto been produced. The only objection that I can see, is, the probability of upsetting the ball in starting, but this can only be determined by experiment. If this upsetting did take place, the resource is then a compound shot, formed by filling a hollow iron

shot with lead. The use of lead for cannon balls would undoubtedly be more expensive than iron; but if the range were very much increased, as the effect would certainly be, its use must become general; and this question appears to affect the workers of lead mines more than others.

CONCLUSION.

As a general principle it may be affirmed, that "*progressive improvement is national power, and that masses of ignorance are powerless when opposed by atoms of knowledge.*" What gave the command of the world to Britain, and even at the present time enables her successfully to combat the rivalry of the nations? Certainly not the numbers of her inhabitants, for they were comparatively few, but the progressive production of knowledge in advance of the nations of the earth, developed by her philosophers, statesmen and mechanics, and they are many and great; and so long as she continues to produce such men

as Bacon, Newton, Shakspeare and Locke, Pitt, Fox, Burke and Sheridan, Brindley, Smeaton, Arkwright, Watt and Stephenson, will she continue to hold her place, and no longer. It is folly to boast and build upon the number of inhabitants in a country, without regard to their power and capability of knowledge, as may be painfully observed from the victories of Alexander, and the triumphs of Cæsar; the cruelties of Cortez, and the butcheries of Pizarro, of the past, to the serfdom of Russia, and the degrading bondage of the African, the meek submission of the gentle Indian, and the stand-still ignorance of the opium-crammed Chinaman, of the present. Such reflections may be thought more fit for the consideration of statesmen and philosophers, than for the humble marksman; but bōth have their part to play, and the progressive advance in the knowledge of firearms has done and is intended to do more for this country, than her sons are fully aware of. The power of progressive mechanical knowledge appears to be possessed at the present era most eminently by the Anglo-Saxon race;

and those of the new world are in full competition with their brethren of the old, and destined to be a people and a name when the land of their origin has sunk into insignificance and decay. Where now do we find the courage and constancy of the patriots of Thermopylæ? Where now do we look for the sternness and frugality of the Spartans? The love and jealousy of liberty displayed by the Athenians? Where are now the productions of Phidias and Praxitiles? In vain do we look to the present degenerate race of Grecians! In vain do we quote the wisdom of Plato and the Philippics of Demosthenes! In vain do we point to the mutilated Parthenon, and the scraps of stone in a national lumber-room! The nation, like to an individual, has sunk into the grave, and its strength and power have departed for ever. Where now do we look for the persevering vanquishers of Pyrrhus and Hannibal, or the stern republicanism of Coriolanus? The greatness of Cæsar, the virtue of Cato, the fortitude of Brutus, and the eloquence of Cicero? Sunk into the grave of the Grecian, the sepulchre

of nations, and nothing remains to point out the past possession of greatness and virtue, but the present existence of insignificance and vice!

Who can foretell the career and destiny of this boasted Anglo-Saxon people? Description is too feeble for imagination. They have already spanned the earth with a girdle, and how soon they may sweep over its surface, like to a devouring flame, an engine of destruction and purification, as yet remains sealed in the hand of the Almighty.

THE END.

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